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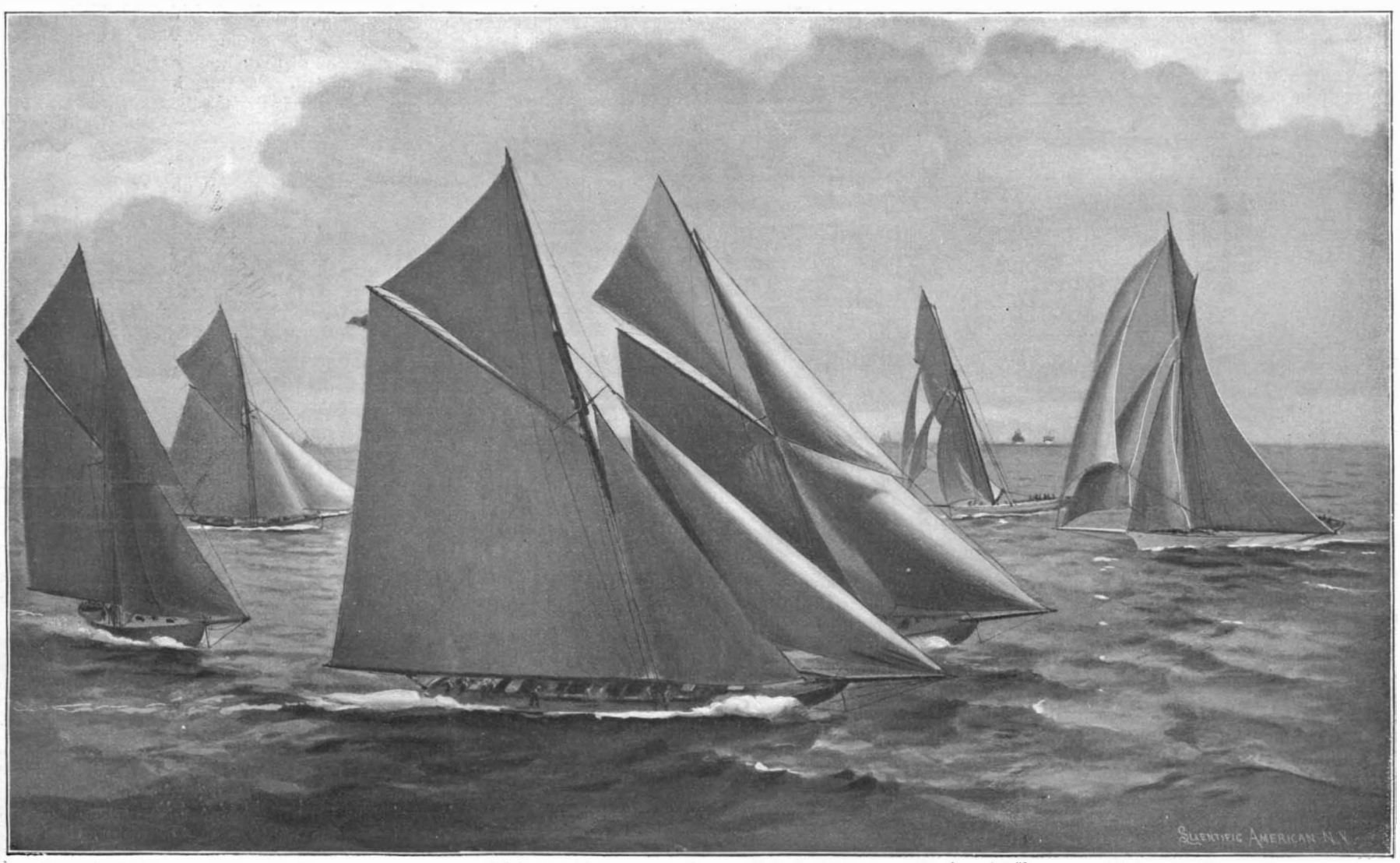
"Columbia," 1871. "Madeline," 1876. "America," 1851. "Mischief," 1881. "Magic," 1870.

First Period—Schooner to Sloop.



"Vigilant," 1893. "Puritan," 1885. "Columbia," 1899. "Defender," 1895. "Mayflower," 1886. "Volunteer," 1887.

Second Period—Sloop to Cutter-Sloop.

FIFTY YEARS OF INTERNATIONAL YACHT-RACING.—[See page 230.]

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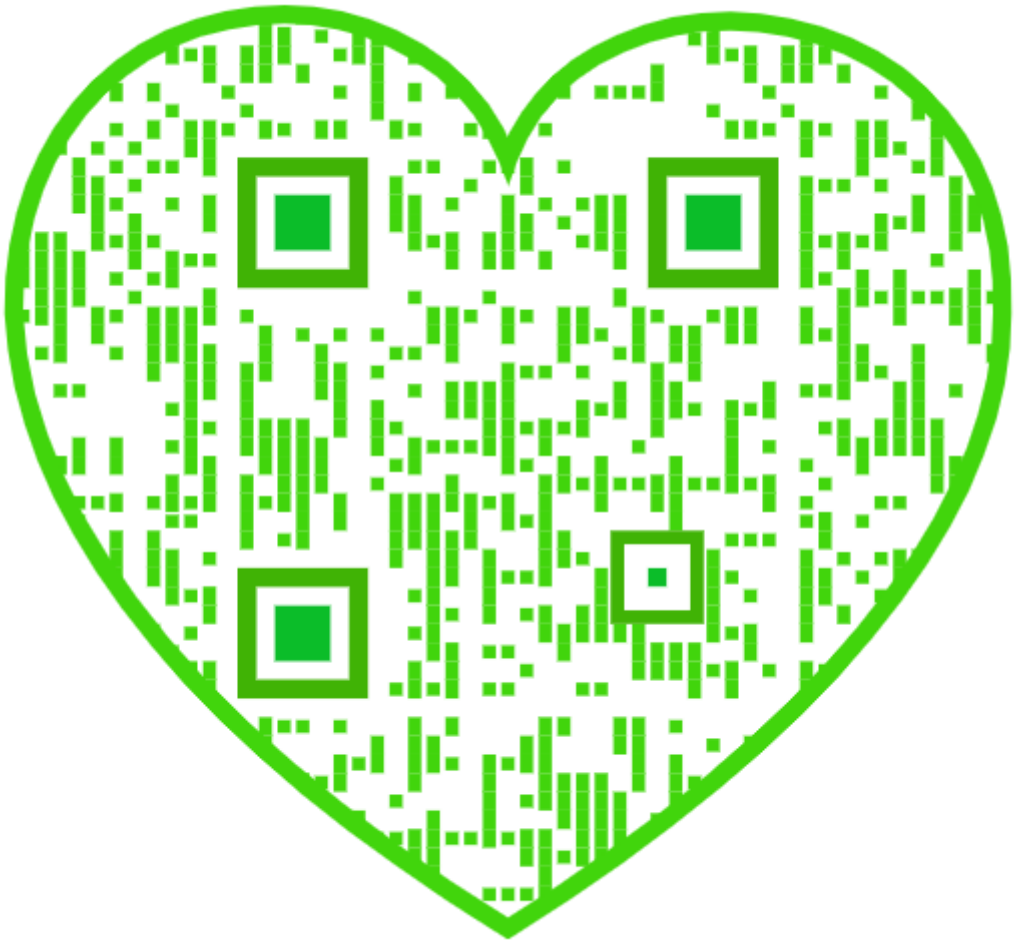

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NEW YORK, SATURDAY, OCTOBER 7, 1899.

KRUPP ARMOR AND CONGRESS.

It will be remembered that at the close of the last Congress it was decided that the contract for the new battleships and armored cruisers should not be let, unless their armor could be secured at or under the price of $400 a ton. It is well understood that the undoubted superiority of the Krupp armor over that manufactured by the Harvey process will render its adoption for future warships a positive necessity, unless, indeed, we are prepared to be left far behind other nations in the defensive qualities of our ships. Those who have any professional knowledge of the question have been at a loss to understand the exact grounds on which the small clique who are responsible for this disastrous deadlock in our naval construction arrived at their arbitrary figures, but anyone who has even a general knowledge of the state of the art knows that any firm that should undertake to produce and sell the new Krupp armor at $400 a ton would soon find itself reduced to insolvency.

It is probable that by this time the United States government is in possession of a complete statement of the facts of the case, prepared by Krupp, the great inventor and manufacturer, in which he deals with the question of price, and proves that the high cost of his armor is amply justified by the consideration of the costly plant and methods involved in its manufacture. We understand that the statement contains detailed information as to the armor plate factory at Essen, in which it is shown that the total cost of the installation up to date has been no less than $5,000,000. On the other hand, the great length of time necessary for the process of cementation, not to mention the slow machining of the armor plate, brings down the annual production to a maximum of 6,000 tons. It is stated by Krupp that if the same amount of capital had been invested in a rail plant, the output would have been considerably over 100,000 tons. From this he draws the conclusion that for capital charges the price for armor plate ought to be vastly greater per ton. Another and equally weighty consideration is that the improvements in the manufacture of armor plate follow each other with such rapidity, and are often of such a radical nature, that the period during which any new and costly plant may be worked at a profit is liable to be of very short duration. For instance, it may be mentioned that it is only seven years since the Harvey process, which is now practically obsolete, was tested on European proving grounds; and while it is true that the Krupp process is essentially a development of Harvey's process, there is always the possibility of the introduction of a new system that will render the existing plant partially, if not altogether, obsolete.

We sincerely trust that when Congress meets again and takes this matter under consideration, the members who have hitherto busied themselves with this question will endeavor to look upon it from a broad and patriotic standpoint. In the first place, the price asked by Krupp is not excessive, and is being willingly paid by the European makers. But even if it be excessive, we had better bear the comparatively slight increase of cost rather than "hold up" indefinitely the work of constructing our new navy. To do this is to be guilty of the stultification which is well described in the old adage which speaks of the folly of "cutting off one's nose to spite one's face."

We have, indeed, heard it whispered that the $400 per ton restriction was imposed with the clear knowledge of the facts that we have stated above, and that it was done for the express purpose of delaying the battleship and armored cruiser construction at a time when some of our shipbuilding firms were not prepared or did not wish to take up any new naval construction. We prefer charitably to hope that the members who were responsible for this "hold-up" were the victims of shortsightedness or lack of information. That any member of Congress could be guilty of such a culpable act as that of imperiling the safety of the country in the interests of a particular industry is too shocking a thought to be entertained without the most positive proof.

THE IMPROVEMENT OF HAVANA.

As we watch the reports which are being sent in by the military governors of the islands that have recently come under our care, we must feel that "peace hath her victories no less renowned than war." If the work of such men as Gen. Wood at Santiago and Gen. Ludlow at Havana is to be taken as a test of what the future has in store for the island of Cuba, we may rest satisfied that the blood and treasure that were spent in the last war were spent to noble ends.

It was Gen. Ludlow who was selected by the government to make an examination of the Nicaragua Canal scheme at a time when a considerable section of Congress was endeavoring to commit the government to a financial indorsement of the undertaking. It was his masterly report, undoubtedly, that saved the country from being plunged prematurely into that colossal undertaking, and it is to the clear insight and courageous impartiality with which he handled the whole subject that the nation is primarily indebted for the present satisfactory relation in which it finds itself to the whole question of a canal at the Isthmus.

Gen. Ludlow's report as commanding the Department of Havana, and as military governor of the city of Havana, covers the period of our occupation up to September 5. It shows that the problem of reorganizing the government of Havana and the uplifting of the city from the state of filth and neglect in which the Spaniards left it, has been taken in hand with characteristic system, energy, and thoroughness. The physical condition of the city at the time of the Spanish exodus was simply shocking. Starvation and death were matters of every-day occurrence. Neglect of the most common sanitary precautions had raised the death rate to alarming figures, which exceeded greatly the all-too-heavy prevailing death rate of the city; and the inevitable restlessness and lawlessness following the removal of the Spanish troops were everywhere conspicuous.

It is gratifying to learn from Gen. Ludlow's own words that "in Havana the rule of law is practically complete," while the country districts are "as quiet and as orderly as the interior of New England." While much remains to be done and many problems are awaiting solution, there is just cause for congratulation from the fact that the death rate, for instance, in June, July, and August was lower than the average for the same months during the past nine years, not even excluding the two calamitous years of the war, 1897 and 1898; while the indications are that the total number of deaths for the current year will be only half the number for 1898. The deaths per month for 1898 were only 162, which is the lowest since 1890.

Gen. Ludlow puts in a plea for better school facilities for the Cuban children, whom he finds to be both bright and docile. We are informed that out of 18,000 such in the city of Havana, only about 5,000 can find accommodation in the public schools.

Such matter as is contained in this report and in others that have been returned by our military governors is excellent reading and should find its way freely into the hands of the American people. We could wish that some provision might be made for the printing and wholesale distribution of such literature. It would do much to remind the American people of the serious pledges as to our humanitarian motives which were made when we entered upon the war, and to show what earnest efforts are being made to fulfill them.

HISTORY REPEATS ITSELF.

The experiment which is being made on the Boston and Maine Railroad with the use of coke as a fuel for locomotives calls to mind the fact that this was the only fuel used for the purpose when railroading was in its infancy. If our readers should chance to come across any engravings purporting to show the early trips of such locomotives as the "Rocket" and contemporary engines, which represent these little engines with dense volumes of smoke rolling from their smoke-stacks, they may be sure that the pictures were not drawn upon the spot. The advantages of coke as a fuel for locomotives because of its cleanliness, splendid heating qualities, absence of clinkers and dirt, not to mention its smokelessness, rendered it an ideal fuel to meet the legislative restrictions of those early days. One of the few objections to it was that the fierce heat engendered in the fire-boxes frequently caused trouble by burning out the fire-bars.

The Boston and Maine Railroad officials have spoken in the highest terms of the behavior of coke in their locomotives, its chief recommendations being that it is smokeless, dustless and completely averts the great risk from setting fire by sparks and hot cinders. It is estimated by the management that this last advantage alone will result in the saving of about $100 000 which has been annually paid in the way of compensation for such fires.

TRADE MARK DECISION BY THE IMPERIAL GERMAN PATENT OFFICE.

Several persons have recently petitioned the Imperial German Patent Office to cancel the trade mark for an emblem consisting of a ball surmounted by a cross and granted for the well-known Chartreuse brand of liqueurs. The petitioners declared that the representation of the ball and cross was a holy symbol, and as a trade mark for liquors wounded their religious feelings, the trade mark thus being an offense under the law.

The Patent Office decided against the petitioners and upheld the trade mark. The decision reads in the main as follows: "Even if the representation of a ball and cross appears on pictures of religious subjects and is used on church statuary as a symbol of the 'Lord's Realm,' it is in itself not to be considered as a specifically religious symbol. The fact that a number of persons object to the use of the ball and cross is not decisive, as the considerations which caused their personal feeling are not sufficient to produce a like feeling in the public at large, even if their statements are considered to be true. There is also no valid reason given that the trade mark tends to mislead the public, as the petitioners also asserted. It is not considered probable that a person would be led to the belief, as alleged, that the goods, with the trade mark in question, represent a beverage blessed by the Church, and that the buyer would believe it to be the performance of a sacred duty toward the Church, as contended by the petitioners."

LAKE CHELAN UPHEAVAL.

Lake Chelan, which is located in the northeastern part of Washington, and which is a large body of fresh water, was the scene of a most remarkable disturbance a few days ago.

About 2 o'clock in the afternoon a very peculiar upheaval was noticed about the center of the lake. At that point, the lake is several miles in width. Suddenly, and without previous warning, the waters were seen to rise to the height of 15 feet or more.

No wind was blowing, and the surface of the lake was as smooth as a mirror, just prior to the upheaval. Huge waves came rolling from the lake's center toward the shores. Persons who watched the upheaval, say the waves came shoreward just like a tidal roller, and burst with great force and fury upon the land.

One steamer, which was moored at one point of the lake, was lifted a number of feet. The lines were all suddenly snapped asunder; the boat was thrown up on a high bank, and when the water receded, the craft was capsized, and sunk.

Many small boats which were moored along the shores were either smashed to pieces by the force of the waves, or swamped. Driftwood was also thrown in great quantities high up on the lake's shore.

Succeeding waves were not so large as the first huge one which burst on the shore; but heavy waves continued to roll in for two hours. Fortunately no persons were out in boats on the lake when the upheaval came. No ordinary small boat could have lived in such waves. No lives were lost.

The disturbance seemed to have extended with more or less force all over the lake, and high waves were noticed all around the shores.

A most remarkable thing happened to Twenty-five Mile Creek, one of the largest streams which empties into Lake Chelan. For some inexplicable reason, the stream went entirely dry for about three hours. After that the waters flowed the same as ever. It was during the time of the upheaval that the stream ceased to flow. The stream flows from far back among the mountains, and the disturbance was some distance from the lake, toward the source of the creek.

The cause of the upheaval is being generally discussed by geologists and scientific men. The commonly accepted theory is that the trouble is due to volcanic origin. No other theory has been advanced yet.

Not within the memory of white men has Lake Chelan been disturbed before in such a remarkable manner. For a great many years the Indians have had traditions which claim that there has long been a volcanic crater somewhere in the vicinity of the lake. Once, so runs the tradition, there was an active volcano, but it has long since become extinct.

The outcome of the scientific investigation which is being made of the peculiar phenomenon is very problematical.

A PHOTOGRAPHIC EXHIBITION.

Preparations are in progress for the first annual exhibition of photographic apparatus and supplies, to be held in Madison Square Garden next October. The National Photographic Exposition Company has been incorporated, and it is expected to be of much benefit to photographic interests by means of an annual display. A most attractive feature of the coming exhibition will be the historical collection, much valuable material being loaned by the Smithsonian Institution, Royal Photographic Society and other societies abroad. They include some of the earliest works on photography, containing samples of forgotten processes. The British government will loan three hundred large, fine photographs of historical places in Great Britain which are among the results of the historical photographic survey of the country, begun by private associations and then passing under government direction.

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THE MANUFACTURE OF PAPER PULP, PAPER AND CARDBOARD FROM PEAT.

BY PAUL HASSACK.

The most recent discovery for the use of peat is the manufacturing of paper from its fiber. This has been so perfected that paper of almost every variety, weight, and quality is produced, while the strength and durability of such is quite equal to that of paper made from any kind of vegetable pulp.

Among all the inventions in the art of paper making there is probably none of such eminent reach and importance as the one reported by this article. Peat, the raw material used, is probably the cheapest possible substance and effectually substitutes almost any of the raw stuffs at present used for the manufacture of paper.

From geological reports which we have at hand we learn that there are immense deposits of peat existing in the United States, especially in the Northern and Western States.

Apparently little attention has been paid to the various uses of peat in this country, and the swamps and bogs in which it occurs are at present almost worthless, but, undoubtedly, this invention will give to them a value never before dreamed of.

A study of the peat itself shows it to be composed very largely of fibrous material.

These fibers come from the remains of moss and grass which growing and decaying in successive generations form the peat. In this submersion and decay, the reeds and grass undergo physical and chemical changes. The organic matter of the vegetation becomes changed, so that little possibility of any fermentation or decay remains, but the fibrous structure is preserved intact. These fibers are found to possess unusual physical properties, being very durable, elastic and non-conducting.

There are various kinds of peat, but it is only the more fibrous grades, which show great strength and resistance on account of their elasticity and immutability, which are used for the production of paper, and the paper itself shows these same properties. While the peat bogs of the United States seem to have attracted little attention, even scientific works making but casual reference to this subject, in European countries peat has been used for various purposes for many years—notably for stable bedding and for fuel. For fuel the peat is subject to high pressure and formed into small briquettes, which have proved a good substitute for coal, possessing almost as high a heating power and being produced at about one-half the cost of coal.

Mr. Karl A. Zschoerner, an Austrian gentleman, who has been interested in the peat business for many years as an owner of large estates covered with peat, recognized the specific properties of the peat fiber, and after numerous experiments was ultimately enabled to turn his investigations to good account by perfecting a process for the manufacture of paper pulp, paper and cardboard from the peat fiber, thus opening up a large new field of industry. This process has been patented in the United States, Canada, British Columbia, Japan and all the European countries.

Already there are in operation several factories in Europe, which are producing large quantities of all kinds of paper from this material and which have proved highly profitable.

From a national economical standpoint, this invention will be of great value, as it will be the means of developing a new field of industry, and lands and territories formerly worthless are now becoming valuable.

The opening of the peat fields and the development of this industry will furthermore retard, in some measure, the destruction of our forests and woodlands, which have, during recent years, become steadily decreased an account of the enormous drain for various purposes, not the least being that of making pulp from wood for the manufacture of paper.

Of peat there are inexhaustible deposits, and statisticians claim that there is sufficient to cover the consumption of paper for about three centuries, so that notwithstanding the naturally increased value of peat lands, now that a use has been found for them, it is impossible that this raw material will attain the value of the present paper stuffs.

The method of making paper pulp from the peat fiber is a simple one, being a cold process. By Zschoerner's method an apparatus called a disintegrator, consisting of five compartments, in which the peat fiber is successively treated by a chemical process and which is at the same time adapted as an hydrostatic pressure apparatus, is used. In these compartments the fibrous peat is subjected to a process which consists mainly of three treatments, as follows:

1. Treatment of the fibrous peat by means of an alkali solution of a concentration not higher than 2 per cent Baumé and gradually decreasing in strength by means of the addition of water—this operation carried out under a high atmospheric pressure, but at a normal, even below normal, temperature. The first step of the treatment is intended to prepare the extraction of the soluble vegetable and earthy matters of the peat fibers.

2. The fibrous material after this treatment is then exposed to a kind of oxidizing process, which acts at the same time as a bleaching agent, for the purpose of opening the fiber and the cleaning of it. At this point a solution of calcium or natrium hypochlorite is used at a normal temperature, but under a still higher pressure.

3. The substance, after being twice treated, is subjected again to an alkali solution, but this time of a strength of about one per cent Baumé at a normal temperature and still under high pressure. By this last step all the earthy and decomposed vegetable matters which have been rendered soluble by the oxidizing process compound with the alkali and are drained off as a colored lye. After this the material is thoroughly washed and can be worked into paper either alone or mixed in percentage with any other paper stuffs with any of the machinery at present in use for paper making, no other special machines being necessary.

The bleaching and even the alkali process may be repeated without any injury to the strength and elasticity of the fiber.

The method described being a cold process also effects considerable saving in fuel, at the same time being very cheap in consequence of the low concentration of the solutions used, and furthermore the whole process is rapidly completed, accelerated as it is by the use of hydrostatic pressure.

Only the more fibrous grades of peat are of value in the manufacture of paper, not those which are commonly called muck and sometimes used as fertilizer, which represent the most decomposed state of peat, being in some instances almost a true coal. Peat beds vary considerably in area and depth, some running as much as 60 feet deep, and of course the deeper the layer the more decomposed is the vegetable matter; but even these lower layers are of value to the manufacturer of peat paper, as they furnish the fuel for the engine of a factory and effect, it is claimed, a saving of at least 70 per cent as compared with coal.

The raised bogs usually produce the most suitable peat for paper making, their accumulation being due to the growth and decay of certain kinds of swampy vegetation of the genus Sphagnum and its numerous varieties.

This plant forms a loose turf and has the property of dying at the extremities of the roots as it increases above, thus gradually forming beds of great thickness. In some localities the Sphagnum moss is replaced by species of Hypnum. The roots and leaves of other plants, trees or their stumps or any other vegetation present may contribute to the accumulation.

Zschoerner's invention is liable to cause changes in the paper market, for it must be admitted that it would be difficult to imagine a cheaper material than peat, which hitherto had little or no value in this country.

THE NEW SMOKELESS POWDER FACTORY.

A new navy smokeless powder factory will shortly be in operation at the Indian Head Proving Grounds, near Washington, and will be capable of furnishing about 2,000 pounds a day. It is now in course of construction, and will be ready for service some time this autumn. The designs were drawn by the Bureau of Ordnance, and Lieut. Bernardou has had charge of the work in the main. With the completion of this factory, says The Army and Navy Journal, the navy will have plants capable of furnishing the service with about four or five thousand pounds of powder a day. This will hardly be sufficient for the service, but the navy does not intend to compete with private firms; still it wishes to have plants which will enable the government to have a source of supply in case of any emergency. A number of buildings are now being completed, including an electric light plant. The buildings, as a rule, are widely scattered, so that an explosion in one would not destroy the others, and there is no large central building. One building is to be used for the picking process, another for the mixing and a third for the dangerous acids. A complete electric car service connects most of the buildings, so that the manufacture of the powder will be greatly expedited. Commander Cowden is in charge of the proving station and the factory.

COMPRESSED PEAT FUEL.

Compressed peat fuel is being made in Canada at Stratford in the Province of Ontario. The peat is obtained from a swamp near by which has an area of 40,000 acres, and the peat bed is from 1 to 20 feet thick. The peat is cut and dried in the air, is then pulverized, passed through a picker and to a hopper which automatically feeds into a 2-inch steel tube 15 inches long. The pulverized peat is forced through this tube by pressure and formed by dies into cylinders three inches long which are almost as dense as anthracite coal. It weighs 83 pounds per cubic foot, weighing 10 pounds less than anthracite coal and being 10 pounds heavier than bituminous coal. It has been tested in locomotives, showing the thermal value of 100 pounds of peat equal to 95·15 pounds of coal. The cost of manufacture is 60 cents per ton. It is said that there are 1,000,000 acres of peat bog in Ontario alone.

SCIENCE NOTES.

A newspaper printed on the excursion steamer "Ophir" published one number in 80° 2′ north latitude. It claims to be the paper published farthest north of any on record.

Formaldehyde acts as a poison when taken internally, and if strong enough to act as an antiseptic should be handled with caution and not allowed to get into the hands of children.

A phonograph outfit was taken to Osborne House on the Isle of Wight and a cylinder was put on to it which conveyed a message of greeting from Menelik. The Queen responded, and the cylinder containing her message was sent to Abyssinia.

A series of experiments made by Benno Erdmann and Raymond Dodge show that in normal reading the letters are not spelled out separately and one after the other, but that a short word of not more than four letters can be read off in less time than a single letter.

Prof. A. R. Crook has returned to Chicago with a number of students after exploring the fossil fields of Wyoming since July 17. Among the fossils obtained was the skeleton of a dinosaur. The size of the femur was 5 feet 2 inches long, which indicates that the big saurian was over 15 feet in height.

A well preserved Roman camp has been discovered in Herzegovina; a section 330 feet long by 270 feet wide has been traced. A portion of the walls, the gates and the doors are still standing and many utensils and weapons have been dug up. It is believed that the camp was erected in the time of Nero.

Japan is to have an Arctic expedition. The government wishes to develop in the Japanese the spirit of adventure and discovery which has rendered the English nation so powerful. The only places available for exploration by sea are the Arctic region of the north and the Antarctic region of the south.

Investigations have been made of sewage irrigation on the truck farms south of Los Angeles, Cal. The health officers have recommended the prohibition of the sale of sewage for the irrigation of land where certain kinds of fruits, vegetables and garden products are grown, stating that the use of sewage for that purpose is injurious.

New York was visited by a strange aerial parade of butterflies on September 7. They were first noticed in the downtown districts just before noon. They were very conspicuous in the downtown parts through the Wall Street region. The butterflies were the Danais Archippus. The weather conditions have been very favorable, which is probably the cause of vast numbers being hatched at just the same time.

The New York Zoological Park, which occupies a part of Bronx Park in the borough of the same name, will be opened to the public about the second week of October. The specimens which will be ready for public inspection will form but a small part of the exhibit. They will be very interesting. A number of buildings have been constructed; between two and three miles of walks have been laid, roads have been built and a sewer system has been put in.

The Navy Department wishes a nautical expert for the Hydrographic Office, and the salary is $1,000 per annum, and the Department of Agriculture desires an ornithological clerk who must have an excellent knowledge of ornithology and mammalogy and his examination will include a practical test in the identification of specimens of birds and mammals. In fact, these two subjects count 70 per cent in the examination to be held. The person who succeeds in passing will be placed on the eligible list, and if selected will receive the munificent salary of $660 per annum.

The great leisure for research which is made in German universities can be understood by reading the figures published in Science: Twenty-two per cent of the professors in the German universities are engaged in lecturing or in laboratory supervision from two to six hours a week, and fifty-one per cent from seven to twelve hours. Of the associate professors sixty per cent are engaged from two to six hours per week, and of the privat-docents eighty-three per cent; only four per cent of all privat-docents are engaged in lecture or laboratory supervision more than twelve hours a week.

The Duke of Abruzzi has found an important mistake in the last map of Franz Josef Land. He says that Cape Flora is really ten geographical miles east of the post assigned on Jackson's map. The map of Payer was riddled by Jackson, who complained of its inaccuracies, but he has himself assigned the wrong position to his own camp. The total expense of the Italian prince's expedition will, it is thought, reach a half million dollars. His baggage is distributed among 1,500 boxes, each weighing about 45 pounds. His belongings are carefully classified, and each variety of apparatus, tools, provisions, etc., has a special color, and each box is painted and numbered according to the class and nature of its contents. The inside of each chest is lined with tin and soldered up to keep out water and dampness.

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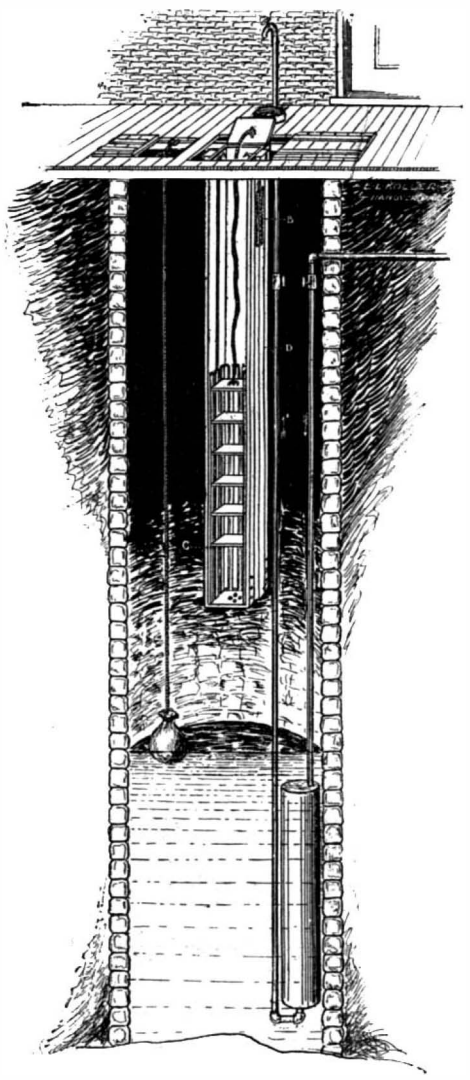
A HOME-MADE COLD BOX AND WATER COOLER.

In the Scientific American of September 9, 1899, page 164, I noticed a cut and an article through the suggestion of Mr. George H. Young, of Elmira, N. Y., entitled "Simple Means of Cooling Drinking Water." Upon this I wish to suggest improvements of my own invention which I had placed in my well. I use a tank of galvanized iron (an ordinary hot water boiler which has been used in Hanover for about twenty-five years); a dumb-waiter; ropes with halter clips attached at one end to staples in joists and the other end fastened to a bag or basket which may contain bottles, etc.

The water tank is connected with the pipes from the



water main. The lower pipe is connected with the bottom of the boiler to draw out any sediment which may gather as well as to get the cold water.

The outside box of the dumb-waiter is 12 feet long by 12 inches by 12 inches nailed against the joists over the well, which is 24 feet deep. The tray is made of laths 6 feet long by 2 inches by ½ inch, with shelves, and is worked by pulleys, *A A*, at the top of outside box and weights, *B*. The ropes are fastened near the lowest shelf, *C*, thereby keeping the tray from falling over when pulled above the surface. A cord is fastened to the top of tray and to the lid of box to raise the tray when heavily laden. The tray is so weighed that when nearly empty it will rise of itself, and is held up by a turn button under the shelf, *C*. The weights work in separate inclosed boxes, *D*, 12 feet long by 3 inches by 5 inches, outside of the large box. Window sash cord is used. A space of about 2 inches is between the trap-door on the porch and the box lid. In the bottom and lower sides of the box are about twenty 2-inch holes to allow the air to pass in and out as the tray moves. By tying loops in the ropes when the weights are up, the tray can be taken out and laid on the porch and thoroughly washed, dried and aired. Any carpenter can make this refrigerator for $10 complete and placed in the well. I have used this plant at my residence for two years and have not bought one pound of ice.

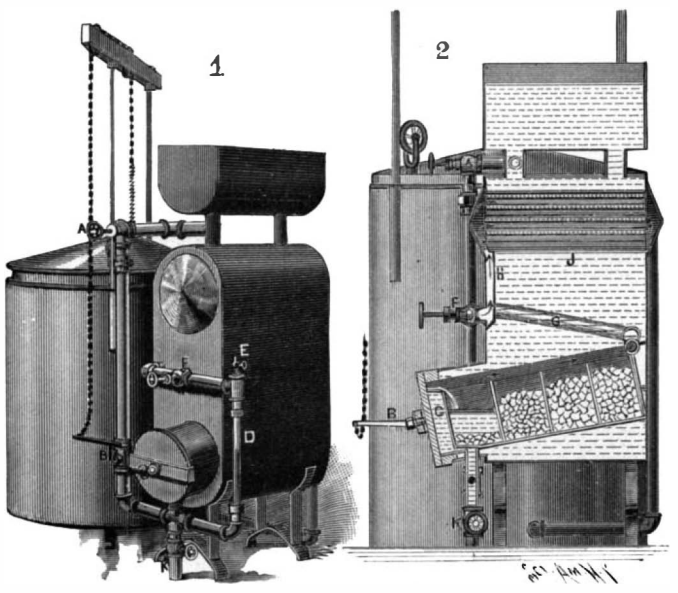
A. C. Wentz, M.D.

AN AUTOMATIC ACETYLENE-GENERATOR.

The improved acetylene-apparatus, which we illustrate in perspective and section, consists essentially of two parts—a gasometer and a generator connected by pipes.

The gasometer comprises the usual water-sealed bell rising and falling in a tank.

The generator comprises a case located alongside of the gasometer and provided with a superposed tank, from which water is supplied to the carbide-chamber. This carbide-chamber, *C* (Fig. 2), consists of an inclined cylinder inserted in the lower portion of the case and projecting outwardly for a short distance. The cylinder contains a drawer divided into a number of carbide compartments. The drawer being inclined, it follows that when the carbide is all decomposed, the compartments will all be filled with water, and consequently, little gas will be lost when the chamber is opened to be cleaned. From the upper end of the carbide-chamber a pipe, *G*, extends to the cooler and thence to the gasometer. Water is conducted to the carbide by means of a pipe connected with the lowermost chamber. The carbide-chamber receives its supply of water from the superposed tank through the medium of a pipe having a valve, *A*, the seat of which is provided with a small by-pass through which water can always flow, so as to prevent the possibility of an inrush of water through the feeding-pipe and, hence, an overproduction of gas. Between this valve and the generator a controlling valve, *B*, is inserted, by means of which the flow of water can be entirely cut off. The valve, *B*, is automatically operated by means of a lever connected by a chain with the gasometer-bell. When the bell has reached its lowermost position the chain is pulled, the lever raised, and the valve, *B*, opened to admit water to the generator. The water-pipe, provided with the valves, *A* and *B*, is connected with the generating-chamber by means of a four-way fitting, with which is also connected a valved drain-pipe, *K*. The fitting is provided with a by-pass pipe extending upward and connecting with a T-valve, *F*, controlling the pipe, *C*, leading to the carbide-chamber. The by-pass is fitted with a water gage, *D*, showing the level of the water in the carbide-chamber and is provided with a vent-valve, *E*. When the carbide-chamber is filled with water and the valve, *F*, is closed, the by-pass allows the water to run off for the renewal of the carbide. The valve, *F*, also controls the passage, *H*, leading to the cooler, *L*, consisting of pipes, the ends of which are covered by caps. The gas flows through the passage, *H*, between the first cap and the side of the case, thence to the space between the opposite cap and side of the case down through a pipe into the gasometer. The inventor of the apparatus is Leonard F. Rose, of New London, Iowa.



AN AUTOMATIC ACETYLENE-GENERATOR.

ELECTROGRAPHS OF THE ELECTRO-STATIC CURRENT MADE WITHOUT A CAMERA.

PROF. ELMER GATES.

During a recent storm here in Washington several men took shelter near some trees, and the bench upon which they sat was struck by lightning. One of the men afterward found upon his body what he called the "picture of a tree." People in speaking about it, and newspapers in writing about it, spoke of it as a photograph of a tree made on his body by lightning. An examination of the photographs of the electric spark herewith presented will make it evident that it was not a picture of a tree which was found upon his body, but a picture of the path taken by the current in spreading over the surface and through the skin. This popular belief that the lightning photographs a tree upon the body of a person struck by a current must, therefore, be abandoned.

I had often photographed the spark—and brush—discharge by means of a camera, but it recently occurred to me to try the action of the spark and current of a frictional machine directly upon the sensitive film under such conditions as would enable me to determine certain facts about the path of the current through a conductive surface. Accordingly I placed a 14 × 17 Cramer isochromatic plate in between the two poles of my ten-plate 32-inch static machine while in full action, and directed the spark directly against the sensitive plate placed within a light-proof envelope, thus allowing the current to photograph its path through the film. The machine was made to run at such speed as to give a rapid succession of sparks at about half its full sparking distance. Then the knobs were drawn farther apart until, at the speed at which the machine was running, the sparking ceased and in its place there occurred a brush discharge. The envelope-covered sensitive plate was then placed vertically between the poles, transversely across the path of the spark, and nearer to the negative than to the positive pole, with the film side toward the positive pole. The positive terminal was then moved toward the sensitive plate until one spark passed, and then quickly drawn back so as to prevent the machine from delivering a second spark. The plate on being developed showed in a most interesting manner and in its natural size the path of the current. The sensitive film is a much better conductor than the glass upon which it is placed, the latter being one of the best non-conductors. Hence the current spreads through the film instead of going through the glass, and leaves traces of its path by depositing

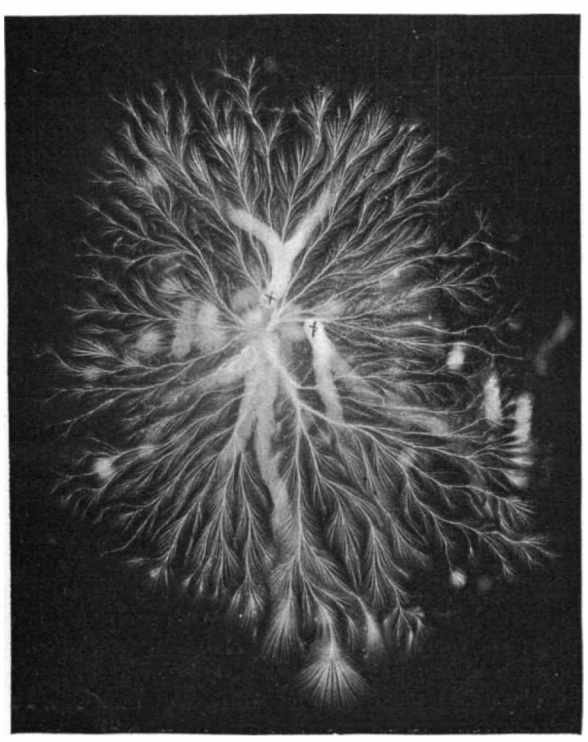


Fig. 1.—AN ELECTROGRAPH.

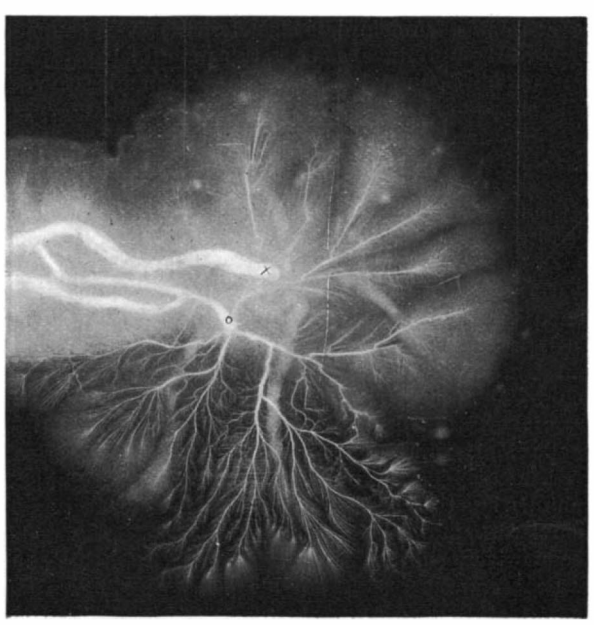


Fig. 2.—FIRST EXPERIMENT.

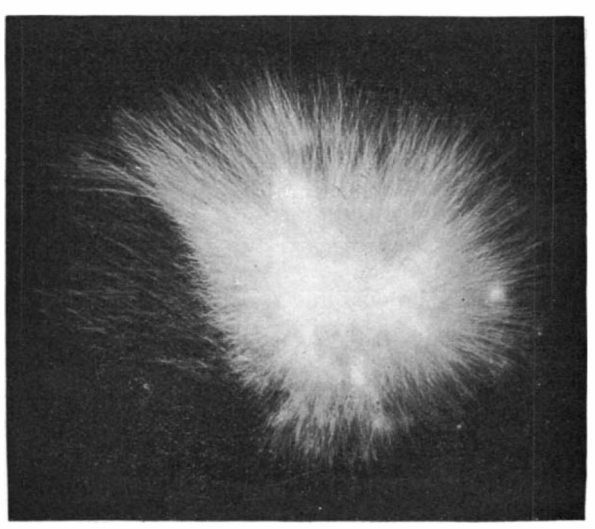


Fig. 3.—BRUSH DISCHARGE.

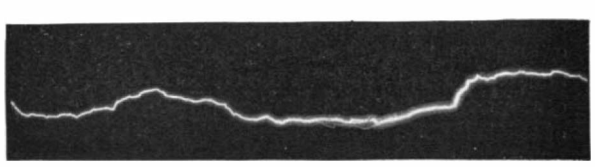


Fig. 4.—DISCHARGE IN AIR

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the silver that lies in its course. In Fig. 1, the spot where the spark struck the plate is shown at *x*, from thence the current diverges in all directions, like the branches of a tree; the branches diverge into twigs, the twigs into leaflets, the leaflets into filaments, and so on, with indescribable complexity of detail. Every part of the current seemingly tends to get farther away

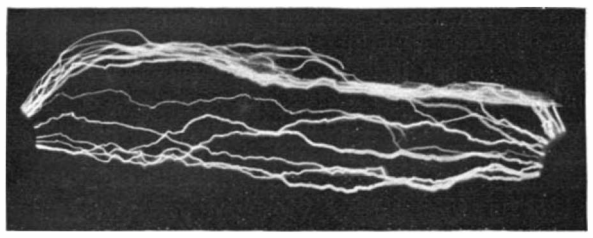

Fig. 5.—MULTIPLE DISCHARGE BETWEEN TERMINALS.

from every other part of itself, but this would be a wrong interpretation of the phenomenon. As is well known, when two currents of electricity pass near each other, and in the same direction, they mutually attract each other. It follows, therefore, that the branching of the current as shown in the picture is not due to any repulsion between parts of itself, but to its tendency to take paths of least resistance in going through a conductor. The film on the glass plate is a conductor, but the glass is not. A conductor has less resistance in proportion as its cross-section is larger and more resistance as its cross-section is smaller. It is

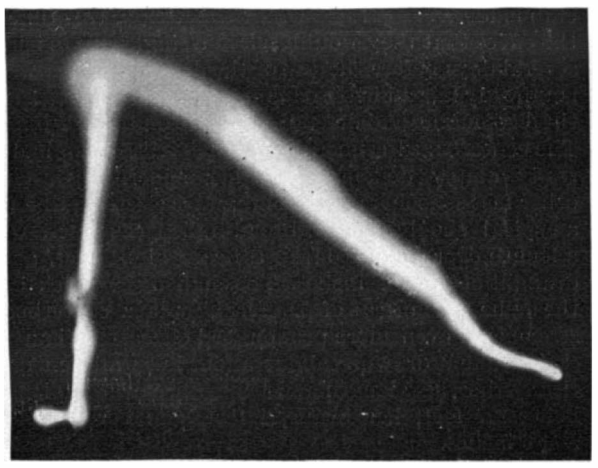

Fig. 6.—DISCHARGE AROUND RUBBER PLATE. PHOTOGRAPHED WITH CAMERA.

evident that where the spark strikes, the film has but little area of cross-section as compared to the larger concentric surface toward which it spreads. The spark on striking the film first touches a small spot, as at *x*, and thence it spreads in all directions radially outward from that spot, because the farther it gets away from the spot the larger the cross-section of the film through which it travels, and consequently the less the resistance. If you use spot *x* as the center and circumscribe a circle one inch in diameter and a concentric circle two inches in diameter, you will understand that when the current has reached, in its radi-

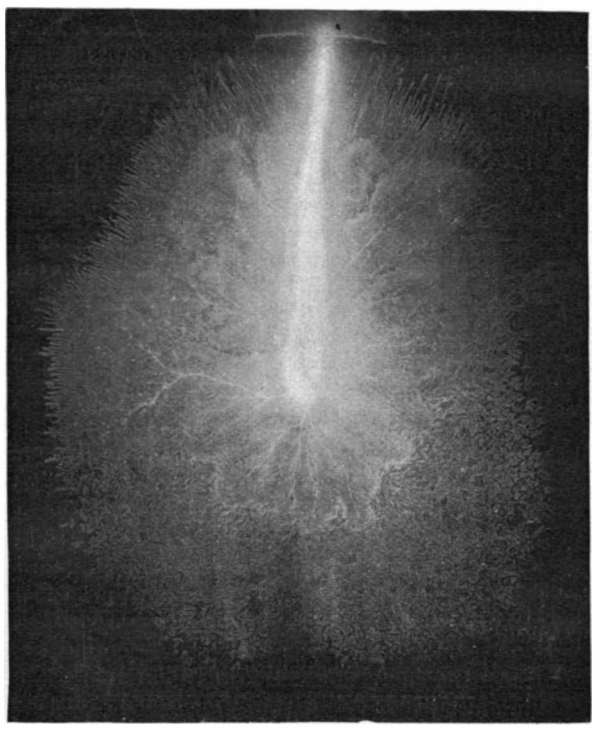

Fig. 7.—DISCHARGE ON PLATE BETWEEN SHELLACKED GLASS PLATES.

ally outward course, the limits of the outer circle, it will be traversing a greater cross-section of the film than when it was at the inner circle. From any given point in a concentric circle around the spot first struck by the spark, the direction of least resistance for the current is radially outward. This is why the current splits up into so many branches, and these again into smaller branches, and so on. But the mutual attraction of currents going in the same direction also influences the branching process. The abrupt changes in direction in any one of these branches can doubtless be attributed to local differences of resistance in the film itself.

The branching paths of the current in the film are not due to areas or lines of conductive substances scattered throughout the film and having less specific resistance than the rest of the film, but to the fact that the conductor grows larger in cross-section most rapidly when the current goes radially outward in all directions, thus making that the path of constantly lessening resistance.

In several places branches may be seen approaching each other and uniting thereafter; but sometimes they cross each others' paths without uniting. In the latter case I judge that one of the currents had passed before the other one had arrived. The current in passing over the film precipitates the silver, and the result is a picture of its path made by the spark itself, and without a camera! When the current strikes the center of the film as at *x*, it tends to spread equally in all directions radially outward, and if the sensitive film had uniformly the same specific conductivity throughout its whole surface and substance the current would still divide up into branches and twigs, because of the fact that radial lines of current would still be produced by paths of least resistance and these paths would be radially outward. If the spark would strike the plate in the exact center; if the plate were exactly transverse to the path of the current; and if the film had a uniform resistance in all parts of itself, we may believe that the picture of a spark made by itself would be symmetrical in its branchings. But differences of resistance in the film would destroy this symmetry, and render the paths crooked, as is shown in some of the branches of Fig. 1. In some of the figures the spark was not wholly conducted by the film; hence it jumped over the top of the plate, leaving a broad white path produced by the light of the spark and a branching figure produced by the current. Fig. 2 is the first electrograph the writer ever made, and it is quite interesting. It shows how one spark, *x*, went wholly around the plate, and how another spark divided, part going around the plate, leaving a light effect in the shape of a white streak, and part being conducted through the film, leaving a beautifully branched tracing of its path.

When the knobs are too far apart to permit sparking, the result is a brush-discharge, and when a sensitive plate is held vertically therein, the result is as shown in Fig. 3.

We sometimes hear it asserted that the course of lightning is not crooked, but straight, and that the crooked appearance is due to the irregular background of clouds. That such is probably not the case is shown in Figs. 4 and 5, natural size, made of sparks 16 inches long, with a camera using a Zeiss 12 × 15 anastigmatic lens. In Fig. 4, at *o*, is shown a portion of the current separating from itself. It is evident that an electric current through the air takes a crooked course.

Fig. 6, made with a camera, shows the spark passing around a rubber disk, thus taking a much longer course through the air in preference to going through hard rubber, which is a much poorer conductor than air. The spark is seen to go straight to the center of the disk, which was held vertically between the poles; straight up to the vertical edge of the disk and parallel to its surface, around the upper edge, and then taking a straight path for the other pole. This gives an idea of the tendency of the current to follow paths of least resistance; the current went almost twice the distance through the air in order to avoid going through a one-sixteenth inch thickness of hard rubber.

In Figs. 7 and 8, I placed the sensitive plate between two glass plates coated with shellac, and allowed the current to enter through the center of one of the plates by means of a small hole in which a metal conductor was placed. Thus, allowing the spark to strike the center of the sensitive plate, on the film-side, and thence to spread radially outward toward a circumference of tin-foil placed on the outer edge of the same plate, through which the hole was made. The effect of thus confining the film between two glass plates is quite unexpected—the appearance is characteristically different from that of all the other photographs herewith sent and I do not attempt to explain the strange marble appearances in the picture. Fig. 15 is also most interesting. The picture was made by making a cylinder an inch in diameter out of a sensitive film such as used in a kodak with the film-side outward. A strip of tin-foil was then rolled over the ends of this cylinder so as to cover the film for the distance of an inch from either end. Around this cylinder was rolled another strip of sensitive film with the sensitive surface inward; and around this was rolled light-proof paper. The roll was then held lengthwise between the knobs of the static machine and a single spark was allowed to pass. Figs. 10 and 11 were made by placing the ends of metallic conductors between two sensitive plates with the film sides facing each other.

When a plate is placed within a light-proof envelope there is a comparative absence of the marble effect which is found when the film is between two good non-conducting surfaces.

The peculiar interest that attaches to these pictures is that they are not photographs, but electrographs. These pictures, except 4, 5 and 6, were made by the

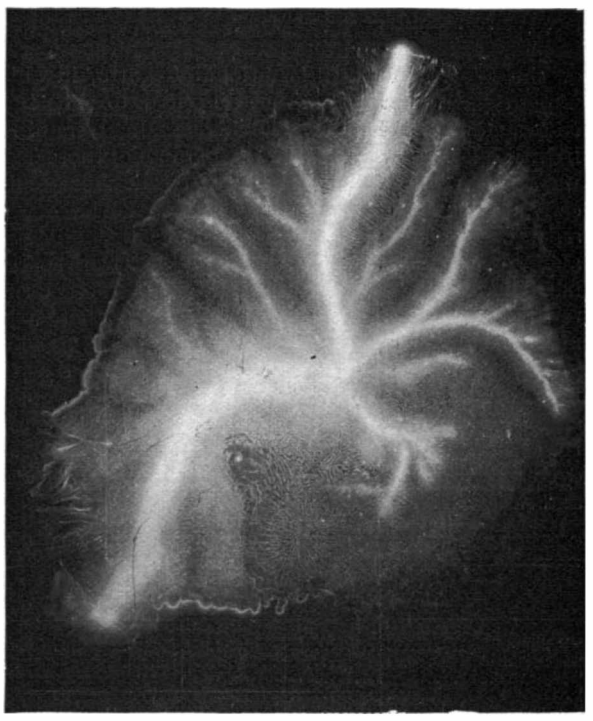

Fig. 8.—SENSITIVE PLATE PLACED BETWEEN SHELLACKED PLATES.

direct action of the electric current and not by the light of the current. The light effects are the broad white streaks, but the branching effects are due to the direct action of the electrostatic current.

THE Department of Labor has recently reported upon the American paper industry for the first six

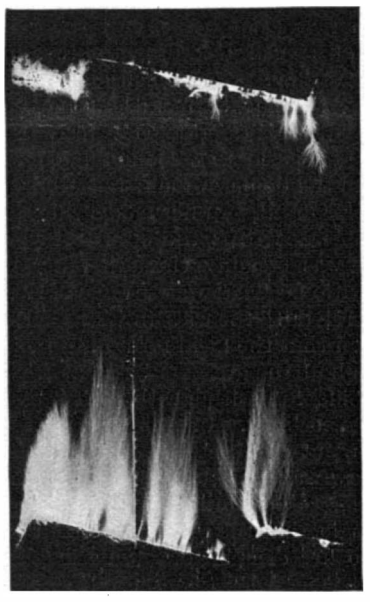

Fig. 9.—DISCHARGE ON CELLULOID FILM.

months of the year 1898. It shows that there were 723 plants in operation, and that the actual product for the half year was 994,087 tons of paper, valued at $48,689,880, and 619,333 tons of pulp, valued at $13,428,-

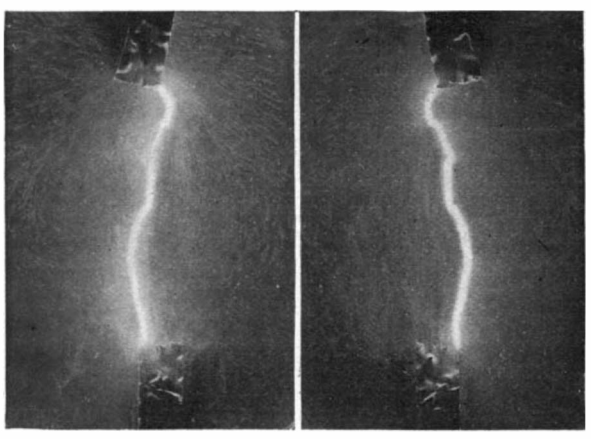

Fig. 10. Fig. 11.
DISCHARGE BETWEEN PLATES FACING EACH OTHER.

542. Nearly one-third of the paper made was for newspapers, and was in the form both of rolls and sheets, and it amounted to 311,898 tons. For books only 124,339 tons were consumed; for wrapping paper, 72,093 tons were used; strawboard, 70,694 tons; and of Manila wrapping paper, 66,383 tons.

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FIFTY YEARS OF INTERNATIONAL YACHT RACING.

I. SCHOONER TO SLOOP.

On a certain Friday morning late in the summer of the year of our Lord 1851, the year of the great World's Fair in London, there was gathered in the famous roadstead off Cowes, Isle of Wight, such a concourse of yachts and pleasure boats of high and low degree as not even that ancient yachting town had seen in the memory of its oldest inhabitants. It was the occasion of the World's Fair International Regatta, in which foreign yacht clubs had been invited to pit their craft against the fleetest schooners and cutters of the British Isles. The start, after the manner of those days, was to be a "standing" one, or to speak more nautically, it was to be made from an anchorage. The contestants, fifteen in all, were moored abreast in a double line, and at the sound of the starting gun, kites were spread, moorings slipped, and the whole fleet moved off merrily to the eastward before a favoring wind, on their sixty-mile race around the Isle of Wight.

The yachts were of all shapes, sizes, and rig, as the following table will show, and the duty of giving to the affair its international flavor devolved upon one rakish-looking schooner, which even to an unpracticed eye presented strong individualities in her model, rig, and sail-plan.

CONTESTANTS FOR THE ROYAL SQUADRON $500 CUP.

Name.	Tonnage.	Rig.
"Brilliant"	392	Three-masted schooner
"Constance"	218	Schooner
"Wyvern"	205	"
"Alarm"	193	Cutter
"America"	170	Schooner
"Beatrice"	161	"
"Gypsy Queen"	160	"
"Arrow"	84	Cutter
"Mona"	82	"
"Ione"	75	Schooner
"Freak"	60	Cutter
"Eclipse"	50	"
"Volante"	48	"
"Aurora"	47	"

The schooner was the yacht "America," designed and built by George Steers for Commodore John C. Stevens and others of the New York Yacht Club for the express purpose of testing American ideas of yacht construction against those which were current at that time in the mother country. Steers was already famous for his fast pilot boats, and the "America" was modeled and rigged according to prevailing American ideas of that day. Her dimensions were as follows: Length on waterline, 88 feet; length over all, 94 feet; beam, 22½ feet; draught, 11½ feet. She carried a large single jib laced to a boom, a lug foresail, a mainsail laced to the boom, a main topsail, but no foretopmast or foretopsail. In her model the "America" was radically different from the crowd of yachts through which she was steadily threading her way into the leading position. That was the age of the "cod's head and mackerel tail" theories in Great Britain, when it was believed that the ideal form for a racing yacht was that which had the greatest beam at a point well forward of amidships, with a rather bluff bow, a long run and a fine afterbody. In the "America," on the contrary, the point of greatest beam was aft of the center, her bow was long and sharp and her afterbody relatively short and full. But it was in the cut and set of her sails that the stranger presented the greatest contrast to her competitors. The English yachtsmen believed that in order to get the best results out of a sail it should be made somewhat "baggy." The mainsails for instance were cut at the foot in a low sweeping curve which hung well below the boom, to the outer end of which the sail was stretched by the usual tackle. The sails of the "America" on the contrary were laced at the foot to the boom and relatively they set "as flat as" the proverbial "board." The consequence was that while some of the English cutters and schooners held their own fairly well with the "America" down the wind, as soon as sheets were flattened in for that supreme test of a yacht, a thrash to windward, the visitor walked away from the home craft in a way that made the eyes of the British yachting sharps bulge with amazement. When the "America" rounded the Needles for the final stretch back to Cowes none of the fleet was in sight, although the subsequent lightening of the wind enabled the diminutive cutter "Aurora," of 47 tons, to overhaul the 170-ton schooner and finish but 24 minutes astern in a race of 10 hours and 34 minutes. This race was sailed, be it said, with no allowance for tonnage; but had such an allowance been made, the "America" would still have beaten the little "Aurora," though by the narrow margin of two minutes.

Such, in brief, is the history of the winning of the Royal Yacht Squadron five hundred dollar cup—popularly, but erroneously, known as the Queen's cup. There was an international race in the same month of August for the Queen's cup over the same course, the Royal Yacht Squadron having decided to throw the prize open to all the world on condition that time allowance would have to be given to the smaller vessels; but the "America" did not enter. The cup won by her and brought to this country is named after the famous schooner, and should always be spoken of as the "America" cup.

THE FIRST CHALLENGE—"CAMBRIA."

Associated with Commodore John C. Stevens in the ownership of "America" were Hamilton Weeks, George L. Schuyler, James Hamilton, and J. B. Finlay. The death of the Commodore in 1857 led to the presentation of the "America" cup by the owners to the New York Yacht Club to be held as a perpetual international challenge cup. The secretary of the club lost no time in forwarding to the leading yacht clubs of the world a statement of the fact and purpose of the transfer of the cup; and having done this he awaited the arrival of a challenge. The wait was a long one, for it was not until the fall of 1868 that a communication was received from an English yachtsman, Mr. James Asbury, suggesting that a "champion schooner" should be sent over the following year "to take part in the matches of the Royal Yacht Squadron," and offering also to race his own schooner, the "Cambria," against the said vessel round Long Island "for the final possession of the 'America's' Queen's (sic) cup of 1851." After a lengthy correspondence, in which Mr. Asbury, among other things, endeavored to bar out the centerboard, the terms of the match were drawn up satisfactory to both parties.

The "Cambria," a deep-keel schooner, was launched in 1868, from Ratsey's famous yard at Cowes—the same Ratsey, by the way, that is responsible for the much-admired sails of the challenger of the present year, "Shamrock." Her leading dimensions were as follows: Waterline length, 108 feet; beam, 21 feet; draught, 12 feet. She had 4 tons of lead on her keel, and 21 tons of lead stowed inside between her frames. Taken all round, she was a capable boat, and a worthy representative of the English racing schooner of that day. To lend additional zest to her visit, James Gordon Bennett, owner of the big schooner "Dauntless," 116½ feet on the water line by 26 feet 7 inches beam, challenged Mr. Asbury to a westward race across the Atlantic, which challenge was accepted. The start was made on July 4, 1870, and the race was won by the "Cambria," which passed Sandy Hook 1 hour and 17 minutes ahead of the American boat.

The race for the "America" cup took place August 8, 1870, and it was sailed under similar conditions to those under which, 19 years before, the "America" had defeated a fleet of English yachts. The fastest schooners of the New York Yacht Club gathered off Stapleton, S. I., and the start was made from an anchorage. At the weather end of the line was the "Cambria," and next to her the famous "America," resolved to prove that the nineteen years of intervening time since she won the cup had robbed her of none of her old-time speed. In addition to the "America," no less than six fast keel schooners chafed at their moorings, and if they should fail to outfoot the English yacht, there was a fleet of sixteen centerboard schooners to be reckoned with, among which were such fliers as the "Magic," "Idler," "Madeline," and "Silvie." The race was sailed over the New York Yacht Club course, and at the sound of the starting gun it was trip anchor and hoist sail. The "Magic" was the first away, and at the lightship she was leading the second boat, the "Idler," by over 5 minutes, the "America" by 12 minutes, and the "Cambria" by 24 minutes and 3 seconds. She held her lead to the finish, beating the "Cambria" by 27 minutes and 3 seconds actual time. The "Cambria" finished in the tenth position, being beaten by two keel and seven centerboard schooners. On corrected time the "Cambria" was beaten by the "Magic" 39 minutes and 12 seconds and by the old "America" 13 minutes and 47 seconds. It was evident that the "America" cup was in no danger of being captured by the English schooners of that day. Compared with the "Cambria," the "Magic" was a small boat. Her waterline length was 79 feet, beam 20 feet, and she was of only 97 tons to the "Cambria's" 227 tons.

SECOND CHALLENGE—"LIVONIA."

Mr. Asbury was not discouraged by his defeat, and immediately on his return to England, he ordered a new schooner from Ratsey, to be named the "Livonia." Her dimensions were as follows: Waterline length, 115 feet 2 inches; beam, 23 feet 7 inches; draught, 12 feet 6 inches; tonnage, 264 tons. Mr. Asbury's second challenge came through the Royal Harwich Yacht Club, and after much discussion, first in England and then in America, in which the New York Yacht Club made the concession that the "Livonia" should sail against one selected vessel and not against a whole fleet, it was decided that seven races should be sailed, the New York Yacht Club to select its champion on the day of the race. The first race was to be over the Yacht Club course, and the succeeding races were to be held alternately off Sandy Hook and over the club course.

On October 16, 1871, the day of the first race, there was a light wind blowing, and accordingly the "Columbia," a remarkable light-weather boat, was selected. The start was made from an anchorage, and the shoal-draught centerboard, taking the lead at the very outset, drew steadily ahead and finished 25 minutes 28 seconds in the lead.

For the second race, 20 miles to windward and return, the "Columbia" was again selected. In this race the "Livonia" did better and led to the outer mark, but she was beaten in the run home, the "Columbia" winning by 10 minutes 33 seconds corrected time.

On the day of the third race the wind was fresh, and accordingly the big keel schooner "Dauntless" was chosen to meet the challenger. Just before starting she met with an accident, however, which led to the "Columbia" taking her place. The strong wind was not to her liking, and she met with a series of mishaps including the disablement of the steering gear, which led to the "Livonia" winning by 15 minutes 10 seconds; this, by the way, being the only race in the whole fifty years of contests in which the English yacht has won.

In the fourth race the "Livonia" was confronted by the big keel schooner "Sappho," of 310 tons. This splendid craft had the following dimensions: Waterline length, 120 feet; beam, 24 feet 9 inches; draught, 12 feet 6 inches. She held the record to Queenstown of 12 days 9 hours 36 minutes, and the defeat of the "Livonia" was inevitable. The race was over the outside course, and in the twenty mile thrash to windward she beat the challenger by 27 minutes 35 seconds; finally winning the race by 30 minutes 21 seconds. In the last race, held over the club course, the "Livonia" was again beaten, this time by 25 minutes 27 seconds.

THIRD CHALLENGE—"COUNTESS OF DUFFERIN."

The next challenge came from the Royal Canadian Yacht Club, and after the usual correspondence, the club made a second important concession, this time to the effect that they would select a single cup defender several days before the day of the first race. This was a manifestly fair and sportsmanlike decision, and placed the challenging and defending yachts on equal grounds. The centerboard schooner "Madeline," which had already amply demonstrated her superiority to the other fast schooners of the club, was selected. She was a typical shoal-draught, broad-hulled schooner, with a length over all of 106 feet, a beam of 24 feet, and a draught of 7 feet 4 inches. The challenger, which bore the name "Countess of Dufferin," was a centerboard schooner of even more pronounced character than the "Madeline," drawing about a foot less water on practically the same length and beam; her over-all length being 107 feet, her beam 24 feet, and her draught 6 feet 6 inches.

Although the Canadian boat certainly made a more creditable showing than the "Cambria" and "Livonia," it was the same old story. In both races the "Madeline" took the lead at once and was never headed. In the first race, sailed on August 11, 1876, she came in a winner by the comfortable margin of 10 minutes 59 seconds; and in the second race, sailed in a very light wind, she won by 27 minutes 14 seconds. It should be mentioned that the brave old "America," now in her twenty-sixth year, requested to be allowed to sail over the course, and her time, taken by the regatta committee, showed that she had beaten the Canadian yacht by 19 minutes and 9 seconds—a striking testimony to the superb qualities of George Steers' epoch-marking vessel.

FOURTH CHALLENGE—"ATALANTA."

Nothing daunted by their defeat, the Canadians resolved upon another trial in New York waters, and Mr. Alexander Cuthbert, the builder and captain of the "Countess of Dufferin," was commissioned to build a 64-foot centerboard sloop for the purpose, a challenge being meanwhile sent on behalf of the Bay of Quinte Yacht Club, of Belleville, Ontario. The "Atalanta," as she was called, was 70 feet over all, 64 feet on the waterline, and had a beam of 19 feet and a draught of only 5 feet 6 inches. The New York Yacht Club possessed already several very fast sloops, and it was now for the first time that the present custom of sailing a series of trial races for the purpose of selecting a yacht to defend the cup was followed. The choice fell upon the sloop "Mischief," a centerboard sloop, 61 feet on the waterline, 20 feet beam, and 5 feet draught, designed by A. Carey Smith. Two races were sailed on November 8 and 10, 1881, in which the Canadian yacht was hopelessly beaten, the "Mischief" winning by the wide margin of 28 minutes 20¼ seconds in the first race and 38 minutes 54 seconds in the second. In both these races it was mainly the fine qualities of the American yacht in going to windward that enabled her to cross the finish with such an overwhelming lead.

(To be continued.)

THE city of New York has made an appropriation of $10,000 for the purpose of making a great relief map of the whole city. The map will be in the neighborhood of 50 feet square, and will show all the important public and private buildings. There will be sectional views of some of our great office buildings, together with models of the best sailing and steam yachts. Buffalo will also be represented in probably the same manner, with a relief map which will show Niagara Falls and its power plants.

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SOLID HYDROGEN.*

BY JAMES DEWAR, F.R.S., ETC.

In the autumn of 1898, after the production of liquid hydrogen was possible on a scale of one or two hundred c. c., its solidification was attempted under reduced pressure. At this time, to make the isolation of the hydrogen as effective as possible, the hydrogen was placed in a small vacuum test tube, placed in a larger vessel of the same kind. Excess of the hydrogen partly filled the circular space between the two vacuum vessels. The apparatus is shown in Fig. 1. In this way the evaporation was mainly thrown on the liquid hydrogen in the annular space between the tubes. In this arrangement the outside surface of the smaller tube was kept at the same temperature as the inside, so that the liquid hydrogen for the time was effectually guarded from influx of heat. With such a combination the liquid hydrogen was evaporated under some 10 mm. pressure, yet no solidification took place. Seeing experiments of this kind required a large supply of the liquid, other problems were attacked, and any attempts in the direction of producing the solid for the time abandoned. During the course of the present year many varieties of electric resistance thermometers have been under observation, and with some of these the reduction of temperature brought about by exhaustion was investigated. Thermometers constructed of platinum and platinum-rhodium (alloy) were only lowered 1½° C. by exhaustion of the liquid hydrogen, and they all gave a boiling point of —245° C., whereas the reduction in temperature by evaporation in vacuo ought to be 5° C., and the true boiling point from —252° to —253° C.

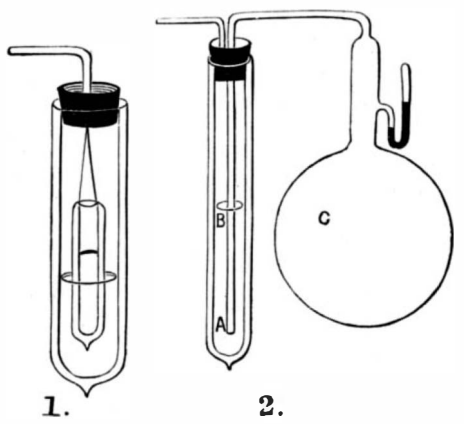
In the course of these experiments it was noted that almost invariably there was a slight leak of air, which became apparent by its being frozen into an air snow in the interior of the vessel, where it met the cold vapor of hydrogen coming off. Where conducting wires covered with silk have to pass through India rubber corks it is very difficult at these excessively low temperatures to prevent leaks, when corks get as hard as a stone, and cements crack in all directions. The effect of this slight air leak on the liquid hydrogen when the pressure got reduced below 60 mm. was very remarkable, as it suddenly solidified into a white froth-like mass like frozen foam. My first impressions were that this body was a sponge of solid air containing the liquid hydrogen, just like ordinary air, which is a magma of solid nitrogen containing liquid oxygen. The fact, however, that this white solid froth evaporated completely at the low pressure without leaving any substantial amount of solid air led to the conclusion that the body after all must be solid hydrogen. This surmise was confirmed by observing that if the pressure, and therefore the temperature, of the hydrogen was allowed to rise, the solid melted when the pressure reached about 55 mm. The failure of the early experiment must then have been due to supercooling of the liquid, which is prevented in this case by contact with metallic wires and traces of solid air.

To settle the matter definitely the following experiment was arranged. A flask, *C*, of about a liter capacity, to which a long glass tube bent twice at right angles was sealed, as shown in Fig. 2, to which a small mercury manometer can be sealed, was filled with pure dry hydrogen and sealed off. The lower portion, *AB*, of this tube was calibrated. It was surrounded with liquid hydrogen placed in a vacuum vessel arranged for exhaustion. As soon as the pressure got well reduced below that of the atmosphere, perfectly clear liquid hydrogen began to collect in the tube, *AB*, and could be observed accumulating until, about 30 to 40 mm. pressure, the liquid hydrogen surrounding the outside of the tube suddenly passed into a solid white foam-like mass, almost filling the whole space. As it was not possible to see the condition of the hydrogen in the interior of the tube, *AB*, when it was covered with a large quantity of this solid, the whole apparatus was turned upside down in order to see whether any liquid would run down *AB* into the flask, *C*. Liquid did not flow down the tube, so the liquid hydrogen with which the tube was partly filled must have solidified. By placing a strong light on the side of the vacuum test-tube opposite the eye, and maintaining the exhaustion to about 25 mm., gradually the solid became less opaque, and the material in *AB* was seen to be a transparent ice in the lower part, but the surface looked frothy. This fact prevented the solid density from being determined, but the maximum fluid density has been approximately ascertained. This was found to be 0·086, the liquid at its boiling point having the density 0·07. The solid hydrogen melts when the pressure of the saturated vapor reaches about 55 mm. In order to determine the temperature two constant volume hydrogen thermometers were used. One at 0° C. contained hydrogen under a pressure of 269·8 mm., and the other under a pressure of 127 mm. The mean temperature of the solid was found to be 16° absolute under a pressure of 35 mm.

All the attempts made to get an accurate electric resistance thermometer for such low temperature observations have been so far unsatisfactory. Now that pure helium is definitely proved to be more volatile than hydrogen, this body, after passing through a spiral glass tube immersed in liquid hydrogen to separate all other gases, must be compared with the hydrogen thermometer. For the present the boiling point, which is 21° absolute at 760 mm., compared with the boiling point at 35 mm. or 16° absolute, enables the following approximate formula for the vapor tension of liquid hydrogen below one atmosphere pressure to be derived:

$$\log p = -6{\cdot}7341 - 83{\cdot}28/T \text{ mm.}$$

where T = absolute temperature, and the pressure is in mm. This formula gives us for 55 mm. a temperature of 16·7° absolute. The melting point of hydrogen must therefore be about 16° or 17° absolute. It has to be noted that the pressure in the constant volume hydrogen thermometer, used to determine the temperature of solid hydrogen boiling under 35 mm., had been so far reduced that the measurements were made under from one-half to one-fourth the saturation pressure for the temperature. When the same thermometers were used to determine the boiling point of hydrogen at atmospheric pressure, the internal gas pressure was only reduced to one-thirteenth the saturation pressure for the temperatures. The absolute accuracy of the boiling points under diminished pressure must be examined in some future paper. The practical limit of temperature we can command by the evaporation of solid hydrogen is from 14° to 15° absolute. In passing it may be noted that the critical temperature of hydrogen being 30° to 32° absolute, the melting point is about half the critical temperature. The melting point of nitrogen is also about half its critical temperature. The foam-like appearance of the solid when produced in an ordinary vacuum is due to the small density of the liquid, and the fact that rapid ebullition is substantially taking place in the whole mass of liquid. The last doubt as to the possibility of solid hydrogen having a metallic character has been removed, and for the future hydrogen must be classed among the non-metallic elements.

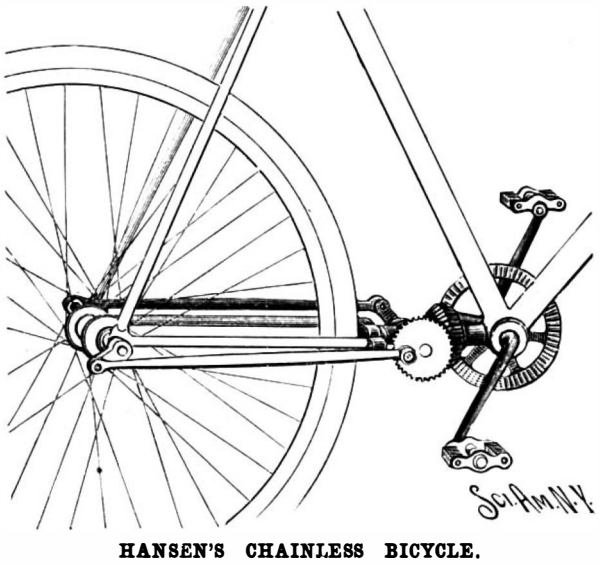


APPARATUS FOR PRODUCING SOLID HYDROGEN.

* Read before the British Association (Section B), Dover meeting, 1899.—From The Chemical News.

A NEW CHAINLESS BICYCLE.

A simple chainless bicycle, in which one-sided strains are avoided, has been patented by Axel H. T. Hansen, Avenida de Mayo 748, Buenos Aires, Argentina, which is noteworthy for its strong construction and for the novelty of its driving mechanism. This mechanism consists of a bevel-gear which takes the place of the usual sprocket-wheel on the pedal-shaft and meshes with a wheel beveled on both front and rear faces and mounted in ball-bearings on the rear stay, which is made single instead of double as usual. The rear face of the doubly-beveled wheel on the side opposite the first-mentioned bevel-gear engages a bevel-pinion secured upon a transverse shaft journaled in the rear stay. The pinion is provided with a crank-pin; and at the opposite side of the pinion the shaft carries a crank. The crank and crank-pin are set at ninety degrees to each other. Similarly located crank-pins are mounted on the hub of the rear bicycle-wheel. Rods connect the two sets of crank-pins on each side.



HANSEN'S CHAINLESS BICYCLE.

The rear wheel, it will be observed, is driven from both sides. By reason of the central position of the doubly-beveled transmission-wheel, lateral strains are minimized, particularly as the main driving-wheel and the bevel-pinion mesh with the transmission-wheel on opposite sides of the longitudinal central plane of the bicycle.

If desired, the rear stays can be enlarged so as to receive and cover the connecting-rods.

Automobile News.

A company is being formed in Italy for the purpose of placing a public service of automobiles in various parts of the country.

Several owners of large cotton fields in the South are investigating the possibility of successfully introducing a steam wagon for the transportation of the cotton crop from the field to the market.

An automobile is being experimented with in Boston for city work. The carriage is used by the Chief of the Public Building Department. The Mayor has ridden in it several times, and it was regarded as very successful.

According to The Horseless Age, Mr. and Mrs. John D. Davis, who were stalled at Toledo, O., have resumed their journey westward. All value to the industry of a trip of this kind is taken out of it by the long delays and the many breakdowns.

An international exhibition of automobiles at Berlin was opened on September 3. There were 140 vehicles shown by 120 exhibitors. An experimental line of electrical omnibuses is being operated in connection with the exhibition by the General Omnibus Company, of Berlin.

The Siemens & Halske Company, of Chicago, Ill., announce they will introduce the Berlin system of automobile omnibuses in Chicago. These cars carry twenty-five passengers and can run on either tracks or paved roadway. They will be operated by storage batteries and can be charged from a trolley line.

The Columbia Company, of Hartford, Conn., who have devoted great attention to electrical vehicles, as our readers are aware, have now turned to gasoline as a source of energy and are experimenting on the same with a view to putting gasoline carriages upon the market. There is an ample field for both gas and electrical carriages.

An automobile exhibition is being arranged in connection with the cycle show which is being held at Chicago, September 25 to October 9. It is the intention of the club to devote an hour during each evening's entertainment to an exhibition of automobiles on the track. One Chicago manufacturer will show twelve of them. A number of private owners of automobiles will show the working of their carriages. It is planned to have a road race between Chicago and Milwaukee at the close of the exhibition, and it is expected that there will be three charging stations on the road.

The University of California Plans.

Last year the regents of the University of California sent out invitations to the architects of Europe and the United States to participate in a competition whose object was to secure the best possible plans for new buildings for the university. A careful programme was outlined, and in deference to European architects, Antwerp was selected as the city where the first competition should be held, and one hundred and one plans were received from architects in every country in Europe and from the United States as well. A representative international jury passed on the plans.

Eleven plans were selected as entitling their makers to enter into the final competition, and a cash payment of $1,200 was made to each, and in addition an appropriation was made sufficient to cover the expenses of a trip to California for the purpose of studying the site which the new building will occupy. Most of those who were successful in the first competition have already made the trip to the Pacific coast. The date for the final competition was set for September 1, and prior to that time all the plans had been received. They were all so elaborate as regards detail that the jury required a week to make its decision. Finally, on September 8, they announced that the plan of M. E. Benard, of Paris, was successful and would receive the $10,000 prize. The choice was unanimous and is indorsed by the local profession as a just award. Messrs. Howells, Stokes & Hornbostel, of New York, received the second prize of $4,000, the third went to a Boston firm, the fourth to Howard & Cauldwell, and the fifth to Lord, Howlett & Hull, of New York. Mrs. Phoebe A. Hearst gave $100,000 for defraying the necessary expense of the competition; she has also promised to bear the cost of some of the buildings. The whole scheme calls for $20,000,000.

GERMANY maintains schools in foreign countries, and a fund is freely voted for this purpose.

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A COURTHOUSE GOING TO COURT.

The citizens of Boxbutte County in the State of Nebraska recently took a vote upon the question of moving the county seat from Hemingford, where it was then located, to Alliance. Both of these towns are, of course, in the county of Boxbutte, and the circumstances which rendered the move desirable were certain changes of population, etc., which rendered Alliance the more desirable location. But while a change of location was desirable there was no necessity for a change of courthouse, as the existing building at Hemingford contained ample accommodations for the business of the county; moreover, the distance from Hemingford to Alliance was only 19 miles, and the level country between the two was singularly propitious for a feat of house moving.

A COURTHOUSE GOING TO COURT.

Accordingly a contract was let to a "house mover" at Lincoln, Nebraska, who, however, after jacking the building up and getting it on its trucks, found that his hauling machinery was not equal to the task, and canceled his contract. The citizens were thus again confronted with the alternative of voting $30,000 bonds for the construction of a new courthouse or making a further effort to move the old building. It is probable that the structure would have stayed in Hemingford but for the fact that the Burlington and Missouri Railroad runs through the county, and being a heavy taxpayer would have had to bear in the taxes levied the major portion of the cost of a new house. The company conceived the bold and certainly original idea of acting as a common carrier for the courthouse itself, and transporting it as so much freight over the 19 miles of track between the two towns in question. Accordingly the building, which measured 38 by 50 feet and towered 51 feet above the rails, was placed upon four 60,000-pound capacity trucks, heavy bridge timbers being interposed between the bottom sills of the building and the trucks to secure an even bearing and properly distribute the load.

Now as the width between rails is only 4 feet 8½ inches and the building was 38 feet wide, it was necessary to steady the structure to prevent it from rolling into the ditch. This was ingeniously done by placing two loaded 60,000-pound coal cars immediately in front and behind the building and guying it with ropes as shown in our illustration, which shows the strange procession under way.

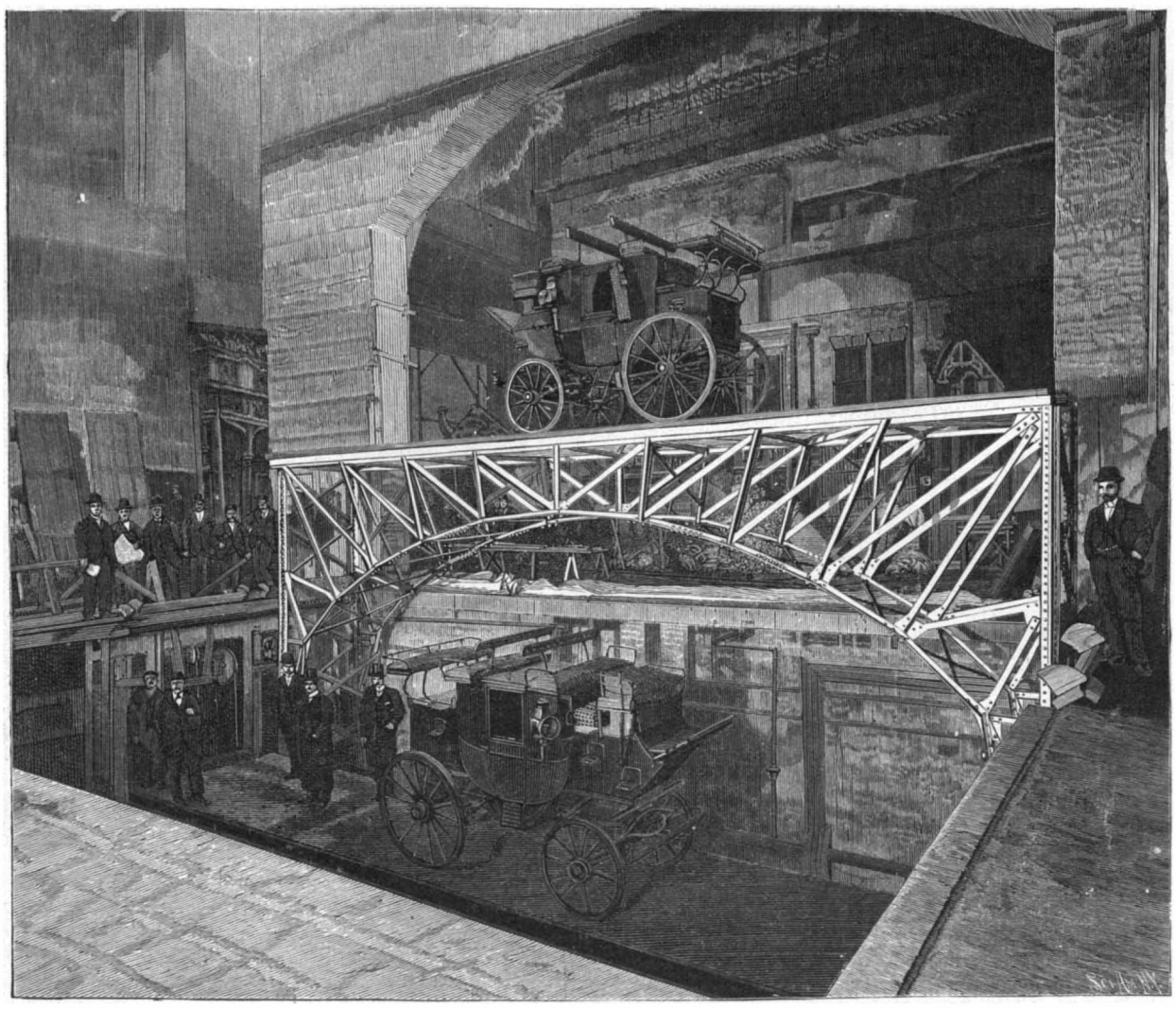
The trip was made without any mishap at a speed which varied from 5 to 8 miles an hour, according to the grades. The only obstacles encountered were some small cuts which had to be reduced to allow the floor of the building to clear them. We are informed by Mr. J. R. Phelan, the superintendent of the road, to whom we are indebted for our particulars, that the building is larger than it appears to be in the picture—the upper story in which the courtroom is located having a 16-foot ceiling. It was aptly remarked by a spectator as the strange procession rolled by that this was "the first time that he ever saw a courthouse going to court."

MODERN STAGE MECHANISM.

The movement known by the name of "stage reform" has of late years received considerable attention in England and has awakened interest at least in the United States. It originated some twenty years ago in Austria with the primary object of encouraging the greatest possible imitation of nature in the mise-en-scène. The rudiments of art as understood by painters, sculptors, and architects were to be applied to the stage and true scenic art was to take the place of the nondescript mounting of plays. It was also considered essential to introduce modern methods of stage mechanism, lighting, etc., and special attention was to be paid to protection against fire, for the movement originated in Austria after the terrible "Ring" Theater fire in Vienna, and since this time the movement has not only surely and gradually developed throughout Austria and Germany, but also spread beyond the frontiers of those countries. The old methods of changing scenes and producing effects which have been in use for a hundred years have been done away with, and the mechanical engineer and the architect have been set to work to revolutionize stage mechanism. The most untiring worker in England is undoubtedly Mr. Edwin O. Sachs, who is the recognized authority on the subject, and our engraving represents a most useful improvement in manipulating the "bridge" of a modern theater stage which he designed. Hydraulic stages are in use in quite a number of places in the world and we have one in this country, but this method of manipulating stages does not appear to have met with very much approval either in England or in America.

To those who are not familiar with stage construction, it may be said that a first-class stage consists of a number of sections termed "bridges" which are 30 or 40 feet long and 8 feet wide. These "bridges" can be raised or depressed to make mountains or caves as the case may be, and in fact, the uses to which they can be put are almost legion. There are usually five or six of these "bridges" separated by narrow flaps. The first theater to do away with the creaking old wooden drums and pulleys of two hundred years standing, worked by manual labor, and substituting electrical power instead, is the Theater Royal, Drury Lane, London, England.

Mr. Sachs divided the main stage into six sections, which are arranged to be moved vertically either 12 feet above the stage level or 8 feet below it, while the fifth and sixth sections were to be built to be moved vertically only, being the most distant from the audience and only to move as a whole; the third and fourth were also to move in a sloping direction, while the first and second sections, besides allowing for a sloping movement, were also to be cut up into moving subsections for traps and the like. For the third and fourth sections hydraulic bridges were used. The fifth and sixth sections were built according to Mr. Sachs' plan and in time the others will also be reconstructed. The bridges are 40 feet long by 6 feet 9 inches wide and an 8-inch flap intervenes between them. The two sections which are worked by electric power embody a new principle for stage mechanism, namely, the principle of the suspended lift partially counterweighted frame taking the form of a bridge, so that what is known technically as a "bridge" on the stage literally becomes a latticework bridge from the engineer's point of view.



ELECTRICALLY OPERATED BRIDGE, DRURY LANE THEATER, LONDON.

The lattice and girders are 38 feet 10 inches long, 5 feet 6 inches wide. They are well braced together as shown in our engraving and form a rigid structure on the top of which is the floor forming a part of the stage. The steel portion of each lift weighs a little more than 4¾ tons and the platform 1½ tons more, so that the total weight is not far from 6 tons. About two-thirds of this weight is taken off from

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the hoisting apparatus by counterweights. In order to prevent the bridges from binding, they are provided with long legs which slide in angle guides attached to steel stanchions. The mechanism which operates the lifts is placed entirely below them in order to allow an unencumbered floor when the top of the lift is flush with the stage. Each bridge has an independent electric motor with drums and cables. Each motor is of 7½ horse power and is of a four-pole inclosed type, the motor being shunt wound. The motors make 520 revolutions per minute. The speed is reduced to the ratio of 104 to 1 through a worm and worm wheel, the worm wheel being geared to a shaft which carries two winding drums which make five revolutions per minute. Upon these drums are wound steel wire ropes which pass over guide pulleys and are connected at four places on the legs of the lift near each corner. The speed of lifting corresponding to the full speed of the motor is 16 feet per minute, but this can be reduced to 6 feet per minute, as desired. Equalizing devices are provided so that the tension on the ropes is rendered uniform. The movement of the lift is controlled by a combined starting and reversing switch which is operated from below the level of the stage from a position by which the operation of the machinery can be observed. Hand gear is provided for working each lift, in case the electric power should fail. Devices are fitted for holding the lifts stationary in case the ropes should break. Very often as many as thirty people would have to be carried on it, or a "tally-ho," as shown in our engraving.

Automatic switches are provided for cutting off the current in case the operator should be derelict in his duty, so that the drums cannot overwind. Appliances are also provided for stopping the bridges at a certain fixed place. The lifts have been tested thoroughly and they have worked with smoothness and without jarring. The new installation may be regarded as a most important advance in stage mechanism, and the subject is so interesting that we publish additional illustrations showing the working of the bridges in greater detail in the current number of the SUPPLEMENT.

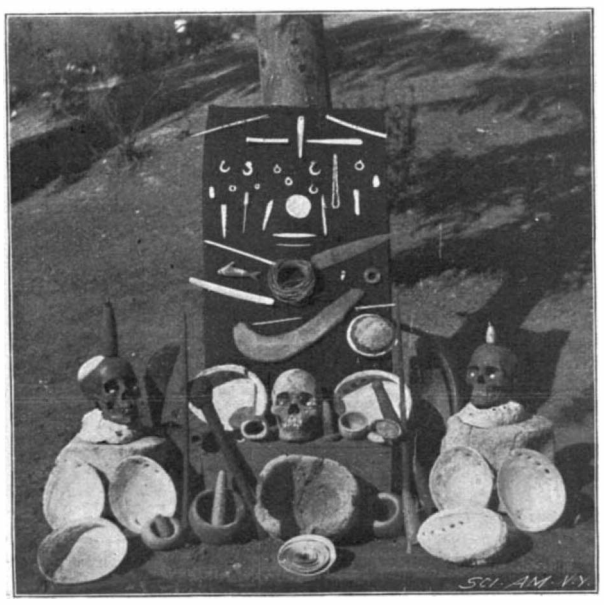
THE WIND-SWEPT ISLAND OF SAN NICOLAS.

BY PROF. C. F. HOLDER.

About seventy miles off the coast of Southern California lies the island of San Nicolas—a veritable desert, wind-swept to such a degree that one might well imagine that the furies are guarding the island. San Nicolas, which is twelve miles long and four or five wide, has no harbors, the anchorage being merely a lee under the low hills; the fact that the wind blows directly offshore making it possible for vessels to anchor here at certain seasons.

On this island, which has been the central point of a romance and tragedy of much interest, deserted and alone, Maria Better Than Nothing, the wild woman of San Nicolas, lived twenty years—long enough to forget her people and even her language. The story is as follows:

For centuries the island was inhabited by a race of hardy mariners who have left their monuments in large shell heaps and mounds that cover many acres. Less than one hundred years ago, the Franciscan fathers determined to take the natives away from the inhospitable island and provide them with homes around the various missions, where they could also be comfortably converted. With this object in view, a vessel was sent to the island, and after much difficulty the Indians, now reduced to about one hundred, were collected, taken aboard, and deserting thousands of implements which their ancestors had used for centuries. When the vessel was about to sail, one of the women discovered that her child had been left behind. But it was blowing a gale and the vessel could not hold, so the captain sailed away, whereupon the frantic mother dashed into the sea and swam back to the shore, making her way successfully through the surf. The captain of the vessel promised to return for the woman, but soon after his vessel was wrecked, and no attempt was made to rescue the poor Indian woman until twenty years after, when a priest determined to make an effort to learn whether she was alive. He enlisted the services of an otter hunter and several Indians, who in a small schooner, known as "Better Than Nothing," set sail for San Nicolas.



IMPLEMENTS FOUND ON SAN NICOLAS ISLAND.

They landed on the island, and very soon found evidence that some one was living there, but avoiding them. To make the search perfect, the men formed a line across the island at certain distances apart, which resulted in the discovery of the wild woman. She was sitting by a brush hut in a cañon, about which was a windbreak of whalebones and various material. She smiled and spoke to the Indians in a language they did not understand, but they fell on their faces before her as though to worship her. She offered them food and readily consented to go with them, and was taken aboard the schooner with a tame otter. She was dressed in the skins of birds, over which was a garment of sealskin. She was named Better Than Nothing, after the vessel, and by signs succeeded in telling some Indians on the mainland something of her history. At first she had mourned the loss of her friends; then the dogs killed her baby, and she wished to die and was sick for a long time.

She was taken to Santa Barbara, where Indians from all about were brought to her to see if they could understand her language; but without avail. She lived with different families at Santa Barbara, but civilization proved disastrous to her, and in less than three months she died. Her remarkable dress of feathers was sent to Rome as a curiosity, and the remains of the unfortunate woman found a resting place in the sanctified ground of the mission.

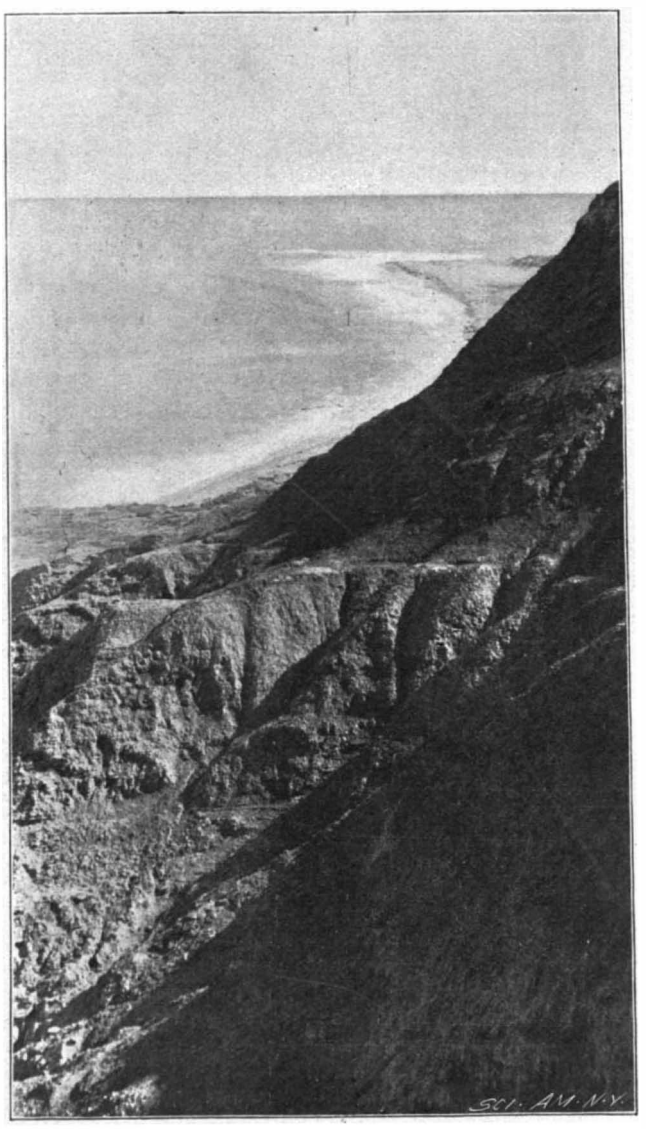
San Nicolas has proved a veritable treasure house for the archæologist, and tons of stone implements have been taken from various mounds on the island. One of the most remarkable shell mounds in the world is found here, being it is said nearly a mile long and ten feet in average height. On its wind-swept surface innumerable objects have been found, exposed during previous hurricanes, with the bodies of Indians facing each other, having been buried in a sitting position with hands clasped over the head. With many remains were buried such personal effects as mortars, ollas, flutes, jewel boxes, charms, flint spearheads, and almost every article needed by a hunting and fishing people, all formed from shell, bone or wood. Fishing lines were made of kelp; sinkers of stone with a groove worn around or a hole in the center; the hook was of elegant design and bore the barb upon the outside.

One of the greatest curiosities on San Nicolas, after all, is the wind. It tosses the sand dunes into the air like wraiths and keeps them continually moving and shifting. It has buried a stone house and so threatened another that the lone herder on the island often deserts it for shelter among the rocks near the sea-lion rookeries, fearing that it will be blown into the sea. For two successive years the writer as guest of Commodore Burnham, of the Santa Catalina Yacht Club, made the attempt to reach this inhospitable island. The first time the yacht was blown away; the second the party was able to land, but owing to the terrific wind was glad to leave. Approaching the island presented a flat and barren appearance, and the yacht finally came to under the lee of strange cliffs that rise from the sea, while to the north a long spit of sand extends to the east. In some places the cliff is worn by the combined forces of water and wind into marvelous shapes and is everywhere difficult of ascent. Some sailors have a superstition that the strange wind that blows from the island is from the souls of the natives, who resent this intrusion and the robbing of their graves.

The yacht's party soon had an experience with the wind. A black fog cloud came sweeping down over the island and the wind blew a hurricane, dissipating the fog and blowing until two o'clock in the morning. The landing was made in a heavy sea—a dangerous operation. The single inhabitant, a French herder, was standing on the sands, looking a typical Robinson Crusoe. He had a big hat strapped on under his chin, an old-fashioned shot gun over his shoulder, a cane in his other hand. Two half-breed shepherd dogs crouched near him. He evidenced no desire to hear from the outer world; his one wish was for beans, which, unfortunately, could not be gratified. He had a small fortune at hand in the antiquities which he could pick up, but he was undoubtedly loath to despoil the graves, though not averse to pointing out the skeletons which had been uncovered here and there. Everywhere the wonderful evidences of the wind were apparent. In one cañon the writer photographed a section that seemed to have almost been carved by Titanic hands. There were great faces, impossible forms of animals, delicate lacelike tracery, all creating a weird effect.

Reaching the summit after a hard climb over cliffs of yellow, blue, white, green and other shades a mesa was found, almost perfectly level, extending for five or six miles. Not an object broke the level that appeared to be

STONE FOREST, SAN NICOLAS ISLAND.



SAN NICOLAS ISLAND LOOKING EAST.

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covered with small polished pebbles, arranged in windrows, that in the gale were blown about and raised into the air with the sand cyclone that accompanied them. For several miles the barren mesa, from which strange cañons reached down to the sea in every direction, was followed. One object of the visit was to locate the spot where Maria Better Than Nothing lived; but it was evident that the isle of winds was ever changing; named after St. Nicholas, it should be mild and gentle, but the reality is a veritable fury. The island seemed to be in the grasp of innumerable sand glaciers, which instead of moving down moved up and were ever shifting in the wind. The cañon in which the so-called wild woman is supposed to have lived is visible. A more deserted spot it is difficult to imagine—a river of sand winding up from the distant sea and covering everything. Here and there rise strange tree-like shapes that resemble the trunk of spectral trees, and which but add to the weirdness of the scene.

Everywhere were evidences of former occupation. Some of the party dug into the mounds, where curious stone slabs marked perhaps the graves of the ancestors of the wild woman. Pearl fishhooks, bone pipes and a flint spearhead were found, standing possibly just where they had been left; and tons of implements have been taken from the surface of the sand dunes.

In one cañon a remarkable drapery of sandstone is being worn out by the wind. In others caves were found, one with strange hieroglyphics painted on the stone. Everything here tells of desolation and death; the sands strewn with the bones of a lost race, the deep cañons filling up with the deadly sand that conceals the remains of unnumbered people who lived here in the past.

The wind does not always blow at San Nicolas. The summer is the season of winds; in winter days and weeks follow when the island is at peace and the sand dunes seem sleeping. But fierce winter storms come suddenly, and the island is not in good favor among the navigators of the Pacific.

SHELL MOUND, SAN NICOLAS ISLAND.

Color Photography for Amateurs.

M. Leon Vidal, the eminent French physicist, whose work in color photography is well known, has recently presented to the Photographic Club, of Paris, a new method of working which is of great value to amateurs. He states that he has been frequently asked whether it was possible, by a comparatively easy process, to obtain positives on glass in natural colors, these being especially interesting for lantern slide projections. M. Vidal has devised a method which has the advantage of simplicity, and is easily within reach of amateurs.

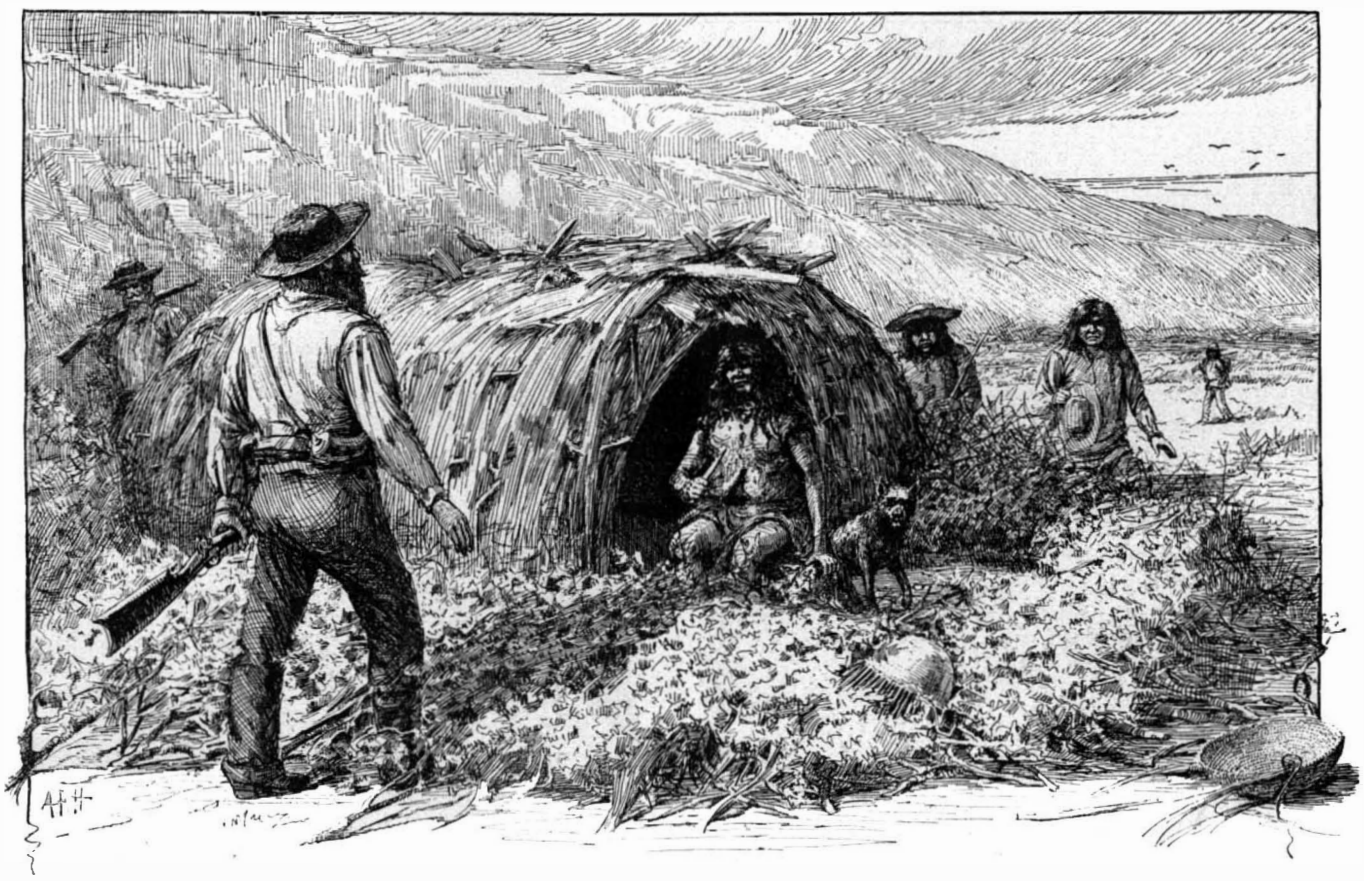
He proposes to give sufficient details to enable any one to obtain good results by carrying out his directions carefully. It will not be necessary to refer to the well-known process of obtaining the three negatives of the object desired, one giving the red rays, the second the green, and the last the violet. However, it will be useful to give the formulæ for the color-screens through which each of these negatives is to be taken. For the orange-red, two parts of eosine yellow and one part naphthol yellow are used, adding the proper quantity of water to give a good color. For the green, two parts of sulpho-green and one part of naphthol yellow are taken, and for the violet two parts of methyline blue and two parts of Paris violet. These solutions are to be filtered with care.

A clear gelatine plate is to be dyed in the solution: this may easily be obtained by dissolving out the silver bromide from an ordinary plate, then washing well and drying.

The plate thus prepared, which should be, of course, nearly transparent, is dyed in the color bath by an immersion of five minutes, agitating from time to time. The color-screens thus formed should be placed quite near the sensitive plate during exposure. For the reds and yellows, orthochromatic plates may be used, and ordinary plates for the violets. After a few trials upon colored bands whose tone is clearly defined, such as violet, blue, green, etc., the time of exposure through each of the screens is determined.

After having obtained the three negatives of the object, taken through each of the color-screens, the object is now to obtain a positive image in natural colors by placing together three positives which are to be made. For this purpose gelatine films are preferable. Eastman kodak films may be used, as they are sufficiently thin and transparent; they may also be printed through the thickness of the gelatine without losing sharpness.

Sensitizing.—A number of short pieces are cut off the roll of film and are then sensitized in a bath of bichromate of ammonia, 0·75 per cent. The immersion in the bath is about two minutes. They are then dried in the dark, being pinned against a board. As in this process the bromide of silver in the plate is a secondary consideration, the operation may be carried on by an ordinary lamp, but when the film is dry it should not be exposed to daylight before putting into the printing frame.



THE WILD WOMAN OF SAN NICOLAS.

Exposure.—The film is applied against the negative with its gelatine side outward, the light thus passing through the negative and through the thickness of the film before reaching the bichromated emulsion. As to the quality of negatives to be used for this purpose, they should be soft rather than too hard. The exposure in full sunlight varies from fifteen seconds to one or two minutes. It is possible, by opening the frame, to watch the progress of the image, but it is somewhat difficult to estimate in this way the exact amount of exposure to give, and the best plan is to use one of the well-known exposure meters, such as Warnerck's. By this means one may note the time of exposure of the proof which gives the best results, and work accordingly.

Development.—After exposure to sunlight, which may, in fact, be replaced by artificial light, the development of the image is proceeded with. This consists in washing out the unaffected portions in a hot water bath at 40° to 50° Centigrade; the positives are washed until the water shows no more traces of silver bromide. To avoid differences in the shrinkage, it is preferable to treat all the films which are developed at a time by water at the same temperature. A part of the bromide of silver has now been washed out with the soluble portion of the gelatine, and it is now necessary to get rid of that which is in the parts corresponding to the image. This bromide has been useful in making the image more distinctly visible, and thus the progress of the development may be noted; it is now dissolved out in a hypo bath of 15 per cent. The film is then washed in running water, and dried against a board.

Coloring of Positives.—Each of the positives is now to be dyed with its appropriate color, blue, red, and yellow, before assembling. To this end it is best to trace upon each of the films the letter corresponding to its color, before the bromide of silver is dissolved out, otherwise, as the films are then nearly transparent, it becomes difficult to identify them. [These colors are the complementary colors of the screens previously used; thus the negative taken through the red screen is to be marked blue, that taken through the green, red; that of the violet, yellow.] The blue to be used is rather inclined toward the green than the red; one of the best colors to use is the so-called metyl green, which in reality gives a very good blue. For the red, erythrome gives fine results; and for the yellow, a mixture of naphthol yellow and eosine yellow is brought up to the desired intensity. These colors are all soluble in water, and the solutions should be carefully filtered. The gelatine side of the film is applied to the surface of the liquid, and in a few seconds the gelatine will absorb the color to the desired degree of intensity. This depends, first, upon the degree to which the image has been printed, and second, upon the degree of saturation of the color bath. With a little practice, one soon becomes able to harmonize these two factors.

After dyeing the films they are dried without washing, and are then ready to be assembled. To this end the blue film is placed upon the yellow, and after having matched the images as nearly as possible, the two films are kept together by slightly gluing the upper corners. As soon as the glue takes effect, the red is put on, and held in the same way. The value of the result is now to be seen. If the exposures and color baths have been made to the proper degree, the result will be a brilliant image in natural colors. If the result is defective, it becomes easy to find the cause. Generally the yellow is good, but the red or blue may be too weak or too strong; it is then easy to correct this by making a new positive to replace one of these, especially if the exposure meter has been used.

When the films are good, they may be definitely mounted between two glass plates. By making stereoscopic positives by this process, remarkable results of relief and color may be obtained. It should be remarked that the colors are likely to fade under the action of strong daylight, and should therefore be protected. Another point to be observed is that the films

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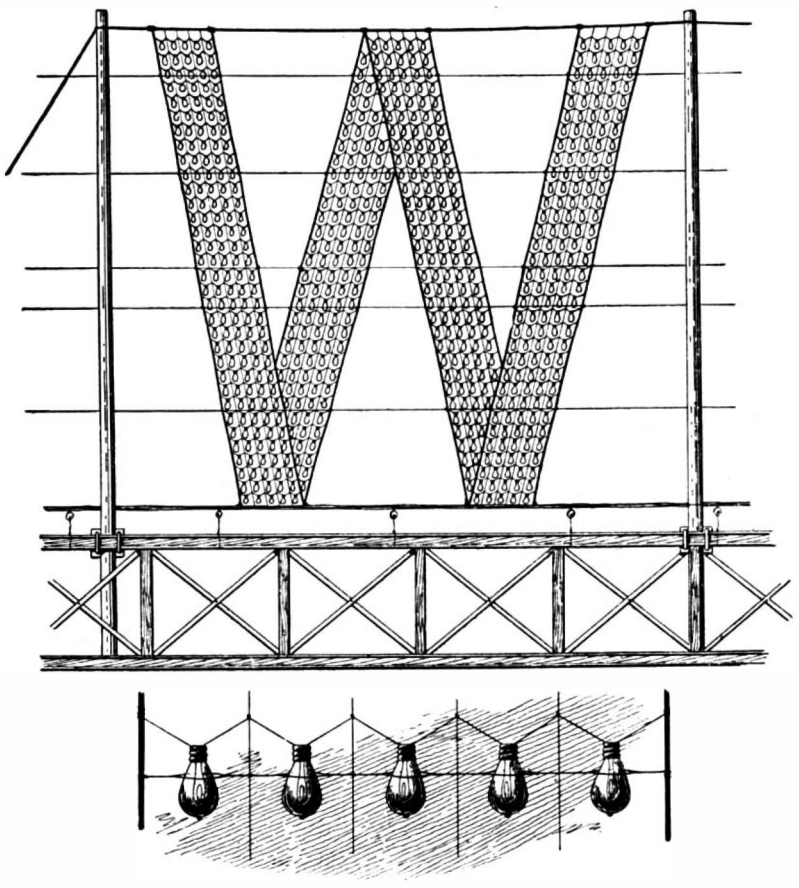
are subject to a certain shrinking, and therefore those which are to be matched exactly should always be worked under the same conditions.

THE ILLUMINATION OF THE BROOKLYN BRIDGE.

Electricity played an important part in the recent celebration in honor of the homecoming of Admiral George Dewey. Electric signs of all kinds were scattered throughout the city, and along the water front several corporations and private firms went to considerable expense to provide illuminated signs composed of incandescent lamps. The Brooklyn Bridge was naturally considered as a rare chance for illumination on a large scale. This was accomplished by erecting the words "Welcome Dewey" in incandescent lights. Each letter was thirty-six feet in height, and the entire length of the two words was 370 feet. The letter "W" alone contained about 1,100 lights and the total number of lights was 8,000. In addition, both of the lofty towers were provided with search lights, and the whole combined with the splendid fireworks made a never-to-be-forgotten scene. Our line cut shows the method of suspending the lamps between the poles. The poles were placed on the southern roadway and were lashed to the superstructure and were held in position with the aid of wires which acted as guy ropes. The lamps themselves were strung upon wires which were stretched between the poles. Before the work was completed it was found that the wind caused so much breakage that every lamp had to be anchored in position by the aid of wires which were twisted around the lamps as shown in our engraving. The current was taken under the roadway by cables and was fed to the latter by feed wires suspended between the posts at the bottom. Switches were provided on the posts to control the lighting. The effect of the gigantic letters was most imposing.



DETAIL SKETCH SHOWING HOW THE LAMPS ARE CONNECTED.

The Color of Blinds.

The remarkable and widely varying properties of the elementary colors which compose white light suggest that the employment of screens as in the blinds placed over our windows should be founded on a scientific basis, says The London Lancet. Our knowledge of the properties of each individual section of the spectrum is not exact, but this much we do know, that the rays of least refrangibility, the red rays, are without direct chemical effects, they occur at the heat end of the spectrum. On the other hand, the rays of the highest refrangibility contain the violet rays which chemically are exceedingly active. It is these rays which are concerned in photography and doubtless also in the great processes of vegetable nutrition and growth. The object of blinds is, of course, twofold—to keep a room cool and to screen out some of the light, so as to avoid the bleaching of coloring materials of the carpets and furniture. At the same time sufficient light must be admitted so that the occupant may see without difficulty. What then is the best color for this purpose? Since light exerts the peculiar action due to the actinic rays which materially and wholesomely affect the air of a dwelling room care should obviously be taken not to exclude all the rays that are so concerned. Thus ruby or orange-red material would be contra-indicated. Abundance of light is inimical to the life of micro-organisms, so that a material in some shape of a compromise should be selected. The best for this purpose is probably a delicately ocher-colored fabric. This would screen part of the active light rays, and if of a fair thickness the greater part of the heat rays, while admitting sufficient active rays to allow of a wholesome effect upon the room and its surroundings. Venetian blinds do not allow of the graduation, which is desirable, of the tone of light which may be adjusted with cloth fabric. As is well known, exclusively red light has been used as a therapeutic agent, and apparently with encouraging results, in measles.

The Human Body as a Caloric Machine.

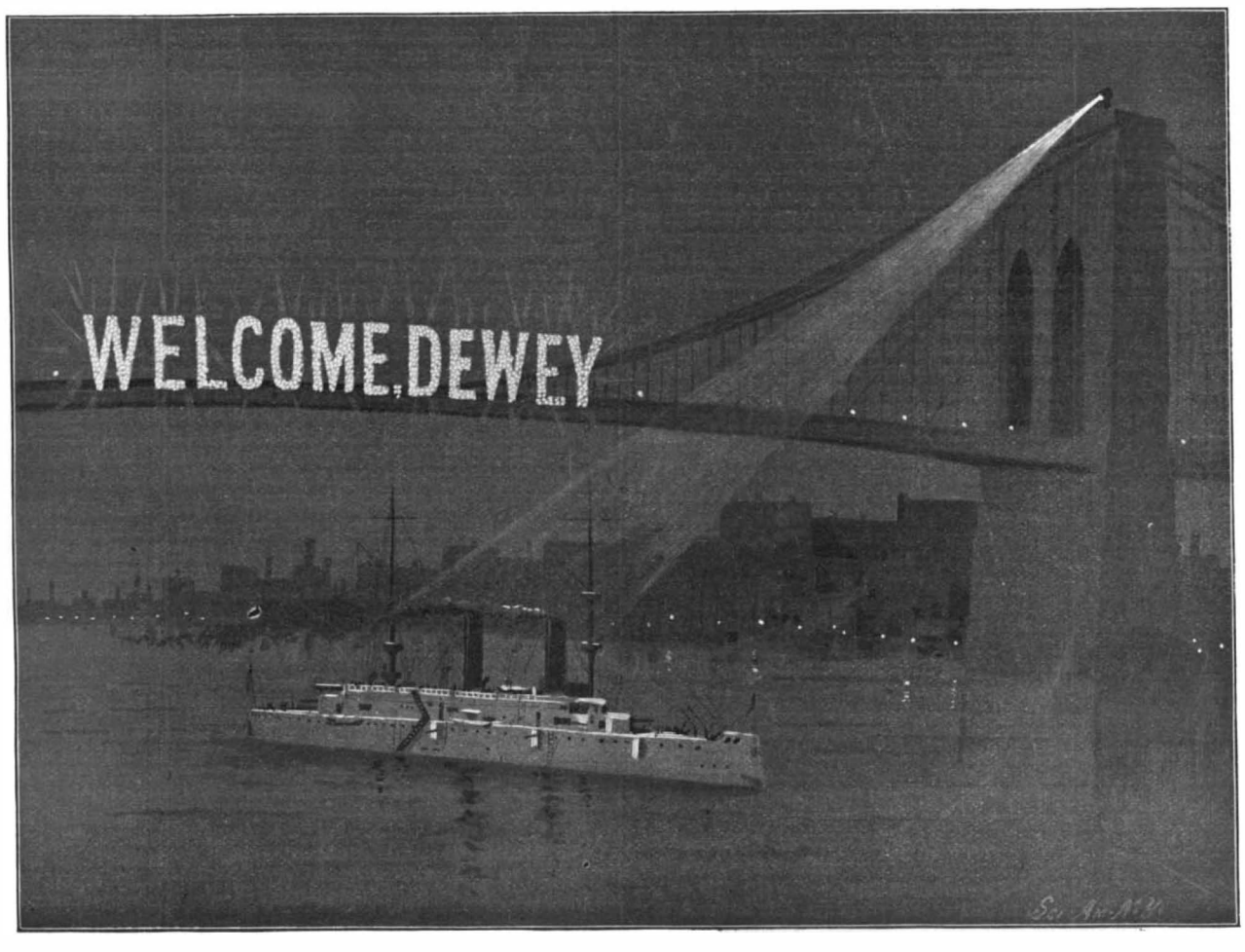
As the efficiency of a steam engine or other machine is considered as the relation of the work performed to the energy supplied to it, it is an interesting question to consider the case of the human system, and to find out what is the relation between the work which an average man is capable of performing and the aliments which he absorbs. A German savant, Rühlmann, has made some important researches in this direction. He considers the body as a caloric machine, i. e., as a motor in which the energy supplied is represented by the heat developed in the combustion, or rather oxidation, of the carbon and hydrogen contained in the aliments. The combustion of 1 kilogramme of carbon develops a quantity of heat equal to 8·08 calories, and that of a kilogramme of hydrogen 34·56 calories. A man of average strength produces in the course of twelve hours the oxidation of 0·252 kilogramme of carbon and 0·0156 of hydrogen. From this it follows that the heat of alimentation equals $0{\cdot}252\times8{\cdot}08+0{\cdot}0156\times34{\cdot}46$, or 2573 calories, corresponding, according to the mechanical theory of heat, to 1,094,000 kilogramme-meters, this figure representing the energy developed in the system.

To find out the average work performed by the individual, we may take as an example that of the Alpine guide considered by Dupin. The mean weight of this man was 70 kilogrammes, the load which he carried 12 kilogrammes, and the duration of his work 10 hours, each hour corresponding to an ascent of 400 meters. Accordingly the total work which he performed in that time was $82\times400\times10$, or 310,000 kilogramme-meters. To estimate the efficiency at which this work was performed, it is only necessary to find the ratio between this figure and that of the energy supplied to the body, as above estimated by Rühlmann, or 1,094,000÷328,000. This gives us 30 per cent as the efficiency of the human motor. Or, if we wish to admit 25 per cent as a fair average, it is seen that a man gives only 25 per cent of the total energy produced by the oxidation of the aliments, the remaining 75 per cent being expended in internal work. This efficiency, it may be observed, far surpasses that of the steam engine and other similar motors, the steam engine giving on an average only 6 per cent of the energy stored up in the combustible.

The Man Who Has a Genius for the Inopportune.

The following from The New Orleans Times-Democrat illustrates the characteristic of persons one is continually meeting.

"There goes a man," said a Canal Street philosopher, "who has made a failure of life in spite of exceptional equipment for success. He is honest, affable, highly educated and industrious as a beaver. He has no bad habits, and I couldn't name a man in New Orleans who possesses a kindlier disposition, yet he is continually out of a job and is studiously avoided by everybody who knows him. The mysterious part of it is that nobody can tell you just why, and the poor fellow doesn't understand it himself. He is beginning to think that somebody has worked a rabbit's foot on him, but the secret is really this: He has a genius for the inopportune. By some malign freak of fate he always says and does the wrong thing at the wrong time. It is not lack of tact; it is destiny. For example, I like him, but he never called on me in his life that his visit wasn't highly unwelcome. He is morally certain to drop in just in time to catch one doing something foolish or discreditable, and you know how we hate the innocent chance witness of our follies. He made a mortal enemy of Col. —— because he happened to walk into his office while the old man was dyeing his mustache. He chanced on a certain prominent lawyer smirking before a mirror, rehearsing an impromptu after-dinner speech, and the prominent lawyer got even by knocking him out of a valuable contract. Those are two cases out of dozens. He never gossips or tattles, but the mere fact that he has seen things he oughtn't to see and heard things he oughtn't to hear makes his very presence embarrassing to the other fellows. It's most unfortunate, and all fate. If he were introduced to a man whose grandfather had been hanged, he'd be absolutely certain to begin talking about rope inside of two minutes. As I said before, he has a genius for the inopportune. My wife loathes him because her false frizzes blew off on the street one day and landed on top of his umbrella. He had nothing whatever to do with either the frizzes or the elements, but now I can't ask him to my house. Terrible to be under such a curse, isn't it?"



THE BROOKLYN BRIDGE ILLUMINATED IN HONOR OF ADMIRAL DEWEY.

OWING to the high price of copper, the imperial postal authorities of Germany propose to replace it for telephonic purposes with aluminum wire or iron wire coated with copper.

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Railroads in Africa.

Railroads in Africa are discussed at considerable length in a monograph entitled Commercial Africa in 1899, just prepared by the Treasury Bureau of Statistics. It shows that the railways now in operation or under actual construction are nearly 10,000 miles in extent, that about two-fifths of the distance from "Cape to Cairo" has already been spanned by railway lines which are being extended from the northern and southern extremities of the continent toward the equator, where they are expected to meet early in the twentieth century. Already railroads run northwardly from Cape Colony about 1,400 miles and southward from Cairo about 1,100 miles, thus making 2,500 miles of the Cape to Cairo railroad complete, the intermediate distance being about 3,000 miles. Mr. Rhodes, whose recent visit to England and Germany in the interest of the proposed through line from the Cape to Cairo is a matter of record, and whose visit to Germany was made necessary by the fact that in order to pass from the southern chain of British territory to the northern chain, he must cross German or Belgian territory, is reported as confident that the through line will be completed by the year 1910. It may reasonably be assumed that a continuous railway line from the southern to the northern end of Africa will be in operation in the early years of the twentieth century. Toward this line, present and prospective, which is to stretch through the eastern part of the continent, lateral lines from either coast are beginning to make their way. A line has already been constructed from Natal on the southeast coast, another from Louronco Marques in Portuguese territory and the gold and diamond fields, another from Beira, also in Portuguese territory, but considerably farther north, and destined to extend to Salisbury in Rhodesia, where it will form a junction with the Cape to Cairo road; still another is projected from Zanzibar to Lake Victoria Nyanza, to connect probably at Tabera with the transcontinental line; another line is under actual construction westward from Pangani just north of Zanzibar, both of these being in German East Africa; another line is being constructed northwestwardly from Mombasa, in British territory, toward Lake Victoria Nyanza, and is completed more than half the distance, while at the entrance to the Red Sea a road is projected westwardly into Abyssinia and is expected to pass farther toward the west and connect with the main line. At Suakim, fronting on the Red Sea, a road is projected to Berber, the present terminus of the line running southwardly from Cairo. On the west of Africa lines have begun to penetrate inward, a short line in the French Soudan running from the head of navigation on the Niger with the ultimate purpose of connecting navigation on these two streams. In the Congo Free State, a railway connects the Upper Congo with the Lower Congo around Livingstone Falls; in Portuguese Angola, a road extends eastwardly from Loanda, the capital, a considerable distance, and others are projected from Benguela and Mossamedes with the ultimate purpose of connecting with the "Cape to Cairo" road and joining with the lines from Portuguese East Africa, which also touch that road, thus making a transcontinental line from east to west, with Portuguese territory at either terminus. Further south on the western coast, the Germans have projected a road from Walfisch Bay to Windhoek, the capital of German Southwest Africa, and this will probably be extended eastwardly until it connects with the great transcontinental line from Cape to Cairo, which is thus to form the great nerve center of the system, to be contributed to and supported by these branches connecting it with either coast. Another magnificent railway project, which was some years ago suggested by Monsieur Leroy Boileau, has been recently revived, being no less than an east and west transcontinental line through the Soudan region, connecting the Senegal and Niger countries on the west with the Nile Valley and Red Sea on the east and penetrating a densely populated and extremely productive region of which less is now known, perhaps, than of any other part of Africa.

At the north, numerous lines skirt the Mediterranean coast, especially in the French territory of Algeria and in Tunis, where the length of railway is, in round numbers, 2,250 miles, while the Egyptian railroads are, including those under construction, about 1,500 miles in length. Those of Cape Colony and Natal are nearly 3,000 miles, and those of Portuguese East Africa and the South African Republic, another thousand. Taking into consideration all of the roads now constructed or under actual construction, their total length reaches nearly 10,000 miles, while there seems every reason to believe that the great through system connecting the rapidly developing mining regions of South Africa with the north of the continent and with Europe will soon be pushed to a consummation. A large proportion of the railways thus far constructed are owned by the several colonies or states which they traverse, about 2,000 miles of the Cape Colony system belonging to the government, while nearly all that of Egypt is owned and operated by the state.

Wireless "Telephony."

Sir William H. Preece has recently been carrying on some interesting experiments on wireless telephony, so called. Four of the poles have been erected near Carnarvon on a sand bank at the southern end of Menai Straits. Half a mile off four similar poles were erected, and half a mile further on is a high pole supporting a coil of wire, one end being anchored in deep water. Between these points he has succeeded in transmitting the sound of a succession of taps. These taps were made with the view of sending messages by the Morse code. They were heard at the receiving station by placing a special telephone to the ear. The system is more rapid than that of Marconi, but the sounds are not as distinct as they might be. As a matter of fact, it is not telephony at all, but a system of telegraphy in which a telephone is used as a receiver.

The Current Supplement.

The current SUPPLEMENT, No. 1240, is of unusual interest. It is one of the best numbers we have ever published. The first article is devoted to the "Steam Yacht 'Josephine,'" which describes and illustrates in great detail the latest and one of the most palatial yachts ever constructed. "Electrical Manipulation of Theatrical Machinery" describes the system which is also referred to in the present issue of the SCIENTIFIC AMERICAN. "The Works of the Diamond Match Company, Limited," describes the beautiful and complicated machinery used in making the boxes and the matches. "An Automobile Street Sweeper and Sprinkler for Use in Paris" is also described and illustrated. "The Lemur" is the subject of a full page engraving. A highly important paper is "Advance in Measuring and Photographing Sounds," by Prof. Benjamin F. Sharpe, M.A. This article is illustrated with engravings showing the apparatus and some of the results obtained. The first installation of this article is published in this issue. "The Literature and Legends of the Philippines" is by Margherita Arlina Hamm. "The Poisons of the Eighteenth Century" is an article giving much curious information. "Roman Roads and Milestones in Asia Minor" is a most attractive article. "International Cloud Work of the Weather Bureau" is by Prof. Frank H. Bigelow.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

MARKER ATTACHMENT FOR PLANTERS.—JOHN GILMOUR, Troy Grove, Ill. The invention relates particularly to means for changing the gage or marker for corn-planters, and provides a simple system of levers which will enable the driver, without leaving his seat, to raise the runner of the marker out of the ground, to throw the gage or marker to the right or left as required, and simultaneously to raise the shovels or cultivator-wheels. The marker can also be held upright and readily dropped to the side. The check or guide-rope usually employed to manipulate the marker is discarded, and thus the necessity of passing the reins over the rope at each change of gage is obviated.

Miscellaneous Inventions.

WEIGHT AND PRESSURE INDICATOR.—EDWARD MCGARVEY, Bellefonte, Pa. By the laws of vibration, a string of ribbon under tension will have a fundamental rate of vibratory motion varying with the stretching force applied to it. The inventor has applied this principle to scale-beams to indicate the weight and pressure of loads. The device is particularly adapted for weighing coal on scales at some distance from the office in which the weight is recorded. By the use of this invention the weighing of loads on various scales may be performed at one office. The weight of an object, it should be observed, may be determined without the use of movable weights on the scale-beam.

ATTACHMENT FOR BASS DRUMS.—CHARLES E. REED, Elmwood, Ill. The object of this invention is to provide a device to prevent a drum from creeping. The attachment consists of an adjustable body at the end portions of which are gripping-arms extending beyond the heads of the drum when the body is attached to the rim. The gripping-arms engage with the rear of the drummer's limbs, thus effectually preventing the drum from moving. These gripping-arms will not interfere in any manner with the use of the drum, and the attachment need not be removed.

CLAY-SCREENER.—EDWARD B. and HENRY A. BADER, Coplay, Penn. The clay-sifter comprises a cylinder composed of a series of rings, the outer surfaces of which are engaged by three triangularly-disposed shafts having spacing-collars between the rings. The shafts are provided with rotative connections. Beneath the cylinder a shaft extends on which disks are mounted having arms entering the slots between the rings. The clay is broken up by the arms of the disks, the finer particles passing between the rings, and the gravel and hard lumps being discharged at the other end of the cylinder.

DEVICE FOR ASSISTING IN TRANSFERRING ENTRIES.—THOMAS B. PASCHALL, Searcy, Ark. This invention provides a device designed to assist in copying figures or writing from the under side of a page of a book to the upper side, or to the upper side of any page without turning the leaf upon which the matter to be transferred is located. The invention employs mirrors so arranged that the writing on the under side of a leaf will be reflected in such a manner that the matter may be correctly read and copied. The device, it is claimed, is as convenient and time-saving as any of the folding or creased leaf balance-books.

STOCK AND DIE.—HANS O. NIENSTAEDT, Copenhagen, Denmark. The invention provides a screw-cutting stock and die, the jaws being separable from each other by the rotation of two lock-nuts, so that the return movement of the tool to its initial position can be rapidly effected. By the employment of a rotating guide-disk, the operator is spared the inconvenience of actuating several loose parts when adjusting a new guide-hole.

HOT-AIR FURNACE.—GEORGE W. MISKIMEN, Jr., Newcomerstown, Ohio. The furnace is intended for use in heating buildings, and comprises, essentially, a cylindrical shell divided into two parts by a partition and provided with a grate in one end, the whole being surrounded by an air-heating chamber having supply and delivery pipes for conducting air. The device is so constructed that the gases of combustion cannot mingle with the heated air.

DOOR-SECURER.—OLE KURE, Chehalis, Wash. To provide a device for the use of travelers in locking the doors of rooms in hotels, is the purpose of this invention. The device comprises a body having a recess extended a portion of its length, to which body plates are pivoted adapted to fold into the recess. A locking-bar is pivoted to the body and has a notch and a head portion for engaging a rearward extension of the outer plate, when the device is folded. The plate holds the body in position, and the plate and body hold the locking-bar in place with the head against the door to prevent the opening thereof.

HIGH-EXPLOSIVE SHELL.—GILBERT JARED, Prairie City, Ill. The hollow body of the shell has a coniform head. A perforated and threaded coupling-plug engages the body and head at opposing ends. These parts are connected with a perforated compression-block having its rear end cupped to form a valve-seat. A coniform valve has a hollow stem slidable through the compression-block, and a plunger-tube slides in the valve-stem and is adapted to detonate the nitroglycerin in the body, when the tube is forcibly driven back. The shell can be exploded by impact or time-fuse only after being fired from a gun.

THILL-COUPLING.—ALBERT H. FORSYTHE, Sarcoxie, Mo. This invention provides a clamp or locking device for connecting the clip with the thill or pole irons or thill or pole couplings, only two parts being needed. The clamp has no nuts and can be speedily attached to or detached from the parts to be united, and used for connections of the ordinary type without any changes. The essential features are found in two members, one of which forms a pivot for the coupling and the other of which is resilient and carries a keeper for engagement with the pivot-member.

FOLDING SEAT.—GEORGE P. STREET, Sr., Elkton, and BENJAMIN H. COURSEY, Sharon Grove, Ky. The seat or chair comprises side frames with one of which a back and a seat have swinging connection. A spring is provided for swinging the back, and a pin on the back engages an inclined lug, on the seat to swing the seat with the back. Chairs thus constructed are of particular service in churches, theaters, and places where it is desired to clear a room of an audience quickly.

LOCK FOR GAS-KEYS.—HENRY A. STUART, Brooklyn, New York city. This lock for gas-keys and similar cocks comprises a valve-casing having stops or shoulders upon opposite sides. A plug valve or key fits the casing and is formed with a hole in which one end of a spring enters, the other end bearing yieldingly against the opposite side of the cock. The two ends are adapted to engage opposite shoulders upon the casing to hold the key closed against accidental turning.

SELF-LIGHTING DEVICE FOR GAS-BURNERS.—ERNST WIESE, Berlin, Germany. The piece of spongy platina applied to the tops of gas-burner chimneys is soon spoiled by the products of combustion. To correct this fault the inventor provides a hole in a cap placed at a certain height above the chimney-top to allow the gas to pass through and reach the spongy platina above the hole in order to be thereby ignited. A clack-valve pivoted at the bottom of the cap to leave the hole open until the gas is turned on and lighted is arranged for closing the whole when acted upon by the rising combustion-products after ignition, so as to lead off the combustion-products along the bottom of the cap to the outside, thus preserving the spongy platina.

SELF-ADJUSTING DRYING RACK.—JOSEPH H. BEAULIEU, Waterbury, Conn. This rack for holding photographs to be dried, comprises a frame having longitudinal bars separated to form a slot between them, upon which bars, cross-slats rest. The central slat is secured to the frame, and the other slats have holes through which guide-rods pass. The slats are held toward the center with an even pressure by means of a spring band, so that the cards are properly supported between adjacent slats.

DEVICE FOR PREVENTING SEA-SICKNESS.—CARLO CALIANO, Turin, Italy. In the opinion of this inventor, sea-sickness is a reflex phenomenon, resulting from acute stimulation of the celiac or stomachic plexus, and he has found that, properly directed pressure upon this nerve-center, will prevent or cure sea-sickness. To effect this compression he employs a belt of peculiar construction which is to be worn about the body.

WIRE-TIGHTENER.—LOUIS H. CLYBORNE, Mound City, S. D. The tightener embodies a holder adapted removably to carry a twisting bar, having near one end two bits capable of gripping the wire and having at the other end a hook serving to engage the wire when it has been twisted around the bits and to keep the wire taut. Each holder is provided with a number of bars.

PERPETUAL CALENDAR FOR PENCIL-CASES, WALKING-STICKS, ETC.—JAMES T. DRAPER, Pingelly, Western Australia. This invention consists in the arrangement of the names of the months, days of the week, and the days of the month upon three separate cylindrical surfaces capable of being moved relatively against one another. The names and numbers are so arranged that future or past dates can readily be ascertained.

SASH AND BLIND LOCK.—EDWARD J. DREXLER, Paterson, N. J. The present invention is concerned with improvements in locking-devices for the meeting-rails of window-sashes and blinds or shutters; and the object is to provide a simple device by means of which the two sashes when closed may be effectually locked together and at the same time lock the outside blind. The essential features are found in a staple screwed in the blind and adapted to engage hook on the window-fastener.

AUTOMATIC DEAD-LATCH LOCK.—CHARLES BACKER, 1742 Lexington Avenue, Manhattan, New York city. In dead-latch locks it is customary to provide a detent which drops behind some portion of the bolt to prevent its withdrawal after the door is closed, except by a key. This invention provides a peculiar construction and arrangement of the parts of a lock of this kind, which may be set into operative engagement by the departing person, thus rendering the locking-detent automatic, locking the latch as each person goes out, and yet permitting the door to be opened with a latch-key.

ICE-CUTTER.—GEORGE A. AMES, Norwich, Vt. The ice-cutter consists principally of a sled which is drawn over the surface of the ice and which carries besides a transverse shaft upon which are mounted toothed power wheels, a circular saw mounted in a swinging frame and connected by suitable mechanism with the power-wheels by which it is rotated. With this device it is possible to cut the ice the desired depth at one operation, thus saving much time in harvesting the ice.

DRAFT-APPLIANCE.—GEORGE N. FARNSWORTH, Grimes, Cal. The appliance is provided with a spreader-bar adapted for attachment to singletrees, with which spreader-bar stretcher-chains are connected, each having a bar upon which a roller turns. The bars are adapted for attachment to a fifth-chain ring. Should the feet of the animals pass over the chains, they will be turned out naturally, the rollers striking the misplaced feet and causing them to be lifted. Thus the present necessity of stopping the team and removing the feet of the animal is obviated.

CUPEL-COOLER FOR ASSAY-FURNACES.—WILLIAM D. LONGWOOD, Deadwood, S. D. In assaying, it

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is customary to place crucibles in the muffle, back of the cupels, to keep them and the metal sufficiently cool for cupellation; but the placing and adjustment of such crucibles requires a great expense of time and labor, which it is the purpose of this invention to obviate. A draft-partition is employed, having transverse draft-openings, one for each cupel, the bottom wall of the opening being below the top of the cupel in front of the opening. A tile-cover is employed, the ends of which project over the cupels and shield them from the heat in the back of the muffle and allow the cool air to collect and pass through the partition openings.

ORE-SEPARATOR.—WILLIAM HOOPER, Ticonderoga, N. Y. This device is designed to separate gold from sand or gravel without the use of water. A flexible bed is secured to an inclined frame and is inclined down to the sides. A series of separating-strips on the upper surface of the bed form channels to receive the heavier particles and direct them to the outer ends of the strips. Plates extending longitudinally of the bed at each side and above the strips form a central conduit. A second series of separator-strips of greater width than the first serve to direct the sand or tailings from each side of the bed to the central conduit.

REIN-SUPPORT.—JOHN G. RYCKMAN, Knappa, Ore. To the bridle a strap is secured by one end, the other end being attached to the hames. A ring is secured to the central portion of the strap; and through the ring the driving-rein passes, whereby a support for the rein will be provided a short distance from and in front of the hames. The attachment does not in any way interfere with the action of the reins upon a bit and renders it well nigh impossible for the reins to become entangled with or pass under the pole or tongue of the vehicle. The rein-guard is adjustable to any size harness and contains no springs or bars to injure the horse.

EGG-SEPARATOR. — JOHN A. BURNS, Woodbine, Iowa. It is the object of this invention to provide an apparatus for separating eggs from the filling material—bran, oats, etc.—in which they are packed and shipped. The egg-separator has a hopper and a rocking cradle with a semicircular reticulated bottom. A slidable egg-holder having a semicircular form is fitted in the cradle. In separating eggs, a woven wire cover is drawn over the cradle and egg-box, to hold the eggs while the box is being inverted, the slidable holder being adjusted to prevent the spreading of the eggs. The filling passes through to the hopper and is discharged.

GASOMETER.—WILLIAM F. COOPER, Meriden, Conn. The inventor of this gasometer has sought to dispense with the usual water-seal and to give the bell a larger range of movement to adapt it for acetylene generators. The invention consists in the special arrangement of two receptacles which telescope or nest, one within the other, and a peculiar connecting-skirt of impervious elastic material connecting the edges of the two members of the gasometer and forming an annular sheath in which the gas is contained in the form of an annular film.

BARREL-SHIELD.—WILLIAM A. FRASIER, Guthrie, Oklahoma Territory. To provide a cover for barrels such as are used in grocery stores, the inventor has devised a shield of tin, zinc, sheet-iron, paper, or other suitable material, plated or japanned in colors and lettered to indicate the contents of the barrel.

CHOKE-BORE ATTACHMENT FOR GUNS.—RANDOLPH P. CORY, St. Louis, Mo. This device is an improvement on a choke-attachment patented by the same inventor; and the present invention provides a means whereby the fastening strain in securing the choke-attachment to the gun-barrel is exerted in lines parallel with the axis of the barrel and choke-section. To the choke-section links are pivoted, provided with latch-devices, the links being adjusted at their pivotal connection with the choke-section by set-screws. In latched position the parts lie parallel with the length of the choke-section, so that the strains are not torsional but are exerted in straight lines.

SASH-HOLDER.—SCOTT A. MORROW and JARRET C. HALCOM, Commerce, Tex. In suitable recesses in the stiles of a sash, springs are held so that they will extend in a direction away from the stile and at an oblique angle to the side edges of the stiles. Friction-rollers on the free ends of the springs engage the guide-strip with their peripheries and the window-frame with their side faces. The holder acts as a guard against the admission of dust, air, or rain, and is hence particularly applicable to railway-cars.

FOLDING COT. — JAMES H. MARTINDALE, Fort Worth, Tex. The object of the invention is to improve the corner irons or brackets connecting the end and side bars and the legs, so that these parts will be rigidly held in their operative position. The frame is so constructed that the legs may be folded inwardly into longitudinal alinement with each other upon the under sides of its end bars; and the removable side bars are formed in two hinged parts of equal length with each section of about the length of the end bars, so that when the side bars are removed, folded, and laid parallel with the end bars and the legs folded upon the end bars, the cot may be rolled up into a compact roll just the length of the end bars.

Designs.

BADGE. — HERMANN SCHAEFFER, Brooklyn, New York city. The leading feature of the design consists of a bust picture of Dewey surrounded by a wreath, at the lower portion of which is a spread-eagle, anchor-arms, and two crossed cannon.

DOOR OR WINDOW SECURER.—GEORGE E. JOHNSON, Brooklyn, New York city. The device is designed to be inserted between the jamb and door or between the sash and frame to prevent the door or window from being opened on the outside. The securer can be carried in the pocket and is of special service in hotel-rooms and the like

MONUMENT.—JOSEPH OSSOLA, Barre, Vt. Upon the monument are represented a broken plant and a worm at the point of fracture as if the plant had been eaten through.

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Minerals sent for examination should be distinctly marked or labeled.

(7726) H. P. W. asks: Which will stand the heaviest current of electricity, silver, platinum, or Mushet steel, without fusing or burning up? A. Platinum has the highest melting point of any of the metals ordinarily used in electrical work. It will therefore carry the heaviest current without melting, the wires being of the same size.

(7727) W. R M. asks the use of and market value of columbium, niobium, or titanium minerals. A. The cost of niobium or columbium, as it is sometimes called, is $7.50 for a 15 grain phial. Titanium costs $2.50 for a 15 grain phial.

(7728) C. G. writes: 1. I have a small motor which runs fairly well, but as a dynamo it will give no current at all. Could you tell me why it will not generate a current? A. The reason your small motor will not generate current when run as a dynamo is that its current is too weak to magnetize the fields. This is usually the case with such motors. They were not designed for generators. 2. Explain why a deal is stronger on its edge than on its flat. A. Your second question regarding the strength of a deal is not easily answered in a few words. Imagine a stick 2×10 inches on edge, one end fastened in a wall from which the stick projects horizontally with a weight hung from the outer end. The upper half of the stick will be stretched by the bending due to the weight, while the lower half will be compressed by it. The leverage of this bending is half the height of the stick, or 5 inches. If the stick were placed on its side instead of on its edge, the leverage of bending would be but one inch under the same circumstances, and the stick would bend much more easily. You will find this fully demonstrated in any book on the strength of materials.

(7729) C. F. T. writes: I write to ask if in your opinion lightning rods are any protection to buildings. A. We are very certain that lightning rods when properly put up are a great protection to any building. They do their work in protecting the building from being struck quite as much as in carrying off the electricity when the building is not struck. For this silent service the rod gets very little credit.

(7730) M. C. W. asks: What is the best solder for to stop a leak in ammonia coils, something that ammonia will not affect. A. Pure tin is the only solder suitable for ammonia joints. It is in general use.

(7731) R. M. asks how can I oxidize brass and copper. A. 1. Dissolve sufficient platinum in aqua regia, and carefully evaporate the resulting solution (platinum chloride) to dryness. The dried mass may then be dissolved in alcohol, ether, or water, according to the effect which it is desired to produce, a slightly different effect being produced by each of the solutions. Apply the solution of platinum with a camel's hair brush, and repeat the operation as often as may be necessary to increase the depth of tone. A single application is frequently sufficient. The ethereal or alcoholic solution of platinum must be kept in a well stoppered bottle, and in a cool place. The aqueous solution of platinum should be applied hot. 2. Oxidizing Copper and Brass.—Immerse the articles in a solution of 2 ounces iron nitrate and 2 ounces sodium hyposulphite to 1 pint of water, until the desired shade of oxidation is acquired, then wash, dry, and brush.

NEW BOOKS, ETC.

THE PSYCHOLOGY OF REASONING. Based on Experimental Researches in Hypnotism. By Alfred Binet. Chicago: The Open Court Publishing Company. 1899. Pp. 188. Price 75 cents.

The publishers have done a signal service in translating the works of Binet and other great psychologists and sending them out in cheap form. We feel sure that this book will appeal to a large number of our readers who are interested in both psychology and hypnotism.

THE SALMON AND SALMON FISHERIES OF ALASKA. Report of the Operations of the United States Fish Commission Steamer "Albatross," for the Year ending June 30, 1899. By Commander Jefferson F. Moser, U. S. N. Washington: Government Printing Office. 1899. Pp. 178.

Like all publications of the United States Commission of Fish and Fisheries, it is a most interesting volume, and is freely illustrated with half-tone engravings. The salmon fisheries have obtained such enormous proportions that the commission is wise in bringing out a monograph on the subject which is exhaustive and important.

THE SOLUBLE FERMENTS AND FERMENTATION. By J. Reynolds Green, Sc.D., F.R.S. Cambridge: The University Press. American Publishers: The Macmillan Company. 1899. Pp. 480. Price, $3.

Various problems connected with the phenomena of fermentation have received remarkable attention during the past few years by many investigators, and the present volume puts in a compact form all the results which have been obtained up to the present time, and it is a remarkably valuable book, and had been needed for some time. The very latest discoveries, such as that of Büchner, of Zymose, are fully noted. Fortunately, there is an index, and had the book been made without this index, it would have been seriously injured.

SAJOUS' ANNUAL AND ANALYTICAL CYCLOPEDIA OF PRACTICAL MEDICINE. Vols. II. and III. By Charles E. de M. Sajous, M.D., and one hundred associate editors. Each volume 600 pages. Philadelphia, New York and Chicago: The F. A. Davis Company. 1899. Price $5.

Very clearly and concisely written, giving a digest of the latest and best facts bearing on the several subjects treated of. Volume II. covers notes between "Bromide of Ethyl" and "Diphtheria." Volume III. "Dislocations" to "Infantile Myxœdema." A book invaluable for physicians.

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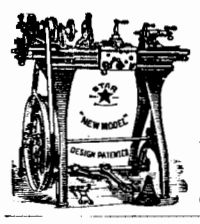

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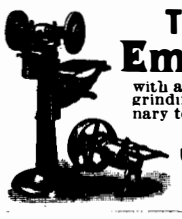

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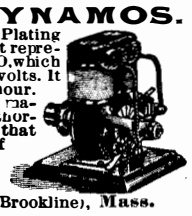

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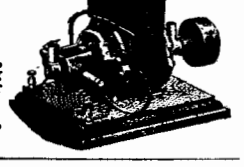

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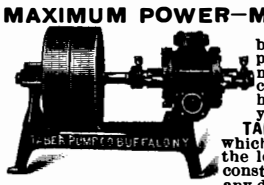

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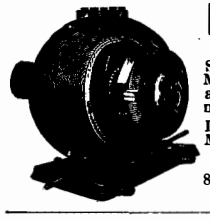

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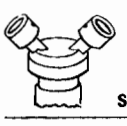

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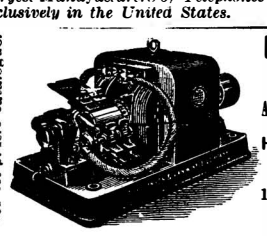

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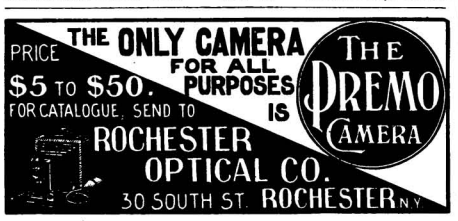
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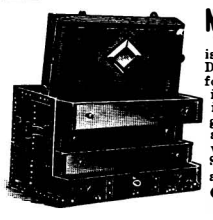

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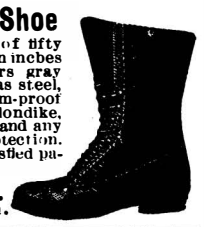

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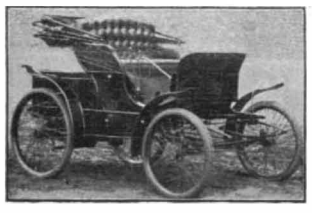

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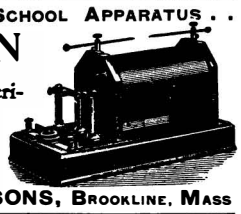

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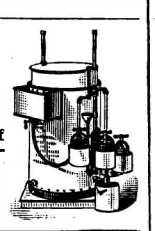

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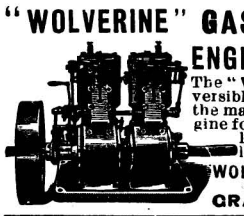

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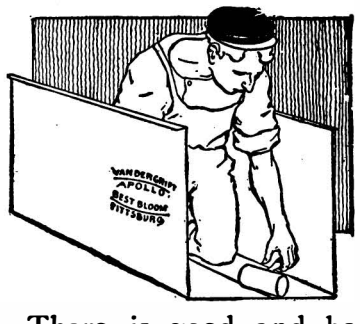

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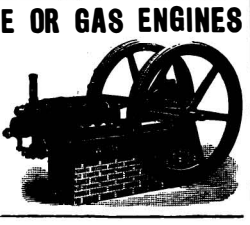

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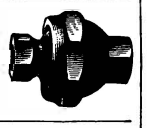

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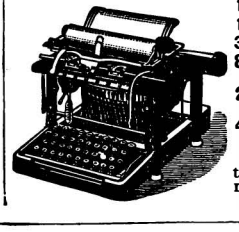

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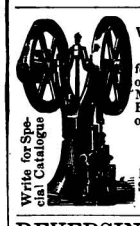

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